THE
VETERINARY JOURNAL

MAY, 1927.

Biography

LIEUT.-COLONEL J. BRITTLEBANK, C.M.G., M.R.C.V.S., D.V.S.M.

THE citizens of Manchester have a phrase which they are very fond of quoting as the final retort in an argument, to the effect that "What Manchester does to-day England does to-morrow," and one wishes that this could be truthfully applied in connection with "Clean Milk"; for there can be no gainsaying the fact that in so far as this question is concerned this Lancashire city leads the way.

We of the Veterinary profession are proud to know that a large measure of this pioneer work has been done, and is still being done, by the present President of the Royal College of Veterinary Surgeons, Lieut.-Colonel Brittlebank.

Colonel Brittlebank's services in this direction in his capacity of Chief Municipal Veterinary Official are too well known to everybody who is connected with municipal hygiene to necessitate an introduction, for his name has been prominently in the front rank of the profession ever since he qualified.

Graduating from the New College, Edinburgh, in 1897, and afterwards taking the Diploma of Veterinary State Medicine of Victoria University, Manchester, he worked in collaboration with the late Professor Delepine over the question of the eradication of tuberculosis from cattle; and the supply of clean, tubercle-free milk, to the citizens of Manchester. The success which has attended their mutual efforts is a real one, for the comparative purity of the milk supply of Manchester is so well known that it is constantly being quoted as an example for other towns to follow; and it is especially appropriate that Colonel Brittlebank's photograph should be the frontispiece of a special "Clean Milk" number of THE VETERINARY JOURNAL. Being now more than half way through his year of office, the members of the profession have had ample opportunity for judging his capabilities to "run the show," and there are no qualms anywhere as to how he will hand over their destinies to the next occupier of the presidential chair. His genial disposition has made him many friends, and his business tact has enabled him to guide the "Ship of State" safely and without accident. During the recent Great European War his qualities as an organiser made him selected to command one of the largest Veterinary hospitals and remount depots in Great Britain, and as a reward for good work done, Colonel Brittlebank was awarded the high honour of the decoration of Commander of St. Michael and St. George.

That he may have health and good fortune to continue to advance the interests of the profession in its municipal side, and thus pioneer the way for the younger generation in Preventive Medicine, is the wish of everybody who enjoys the privilege of his friendship.

Editorial

FURTHER PRACTICAL COMMENTS APPERTAINING TO THE PRODUCTION OF "CLEAN MILK."

So much interest has been shown by our contributors in the question of "Clean Milk" that it has been found necessary to extend the discussion into another number, and it will be seen by our readers that, as with the articles in the April issue, the "practical" aspect of the question is the one which is mainly to the fore.

For example Dr. Savage, the well-known Medical Officer of Health for the County of Somerset, takes up the aspect of the relationship of the application of the recently enforced Tuberculosis Order and its relationship to the production of "clean" milk; drawing attention to the necessity (in Somersetshire at any rate) of a more thorough and searching use on the part of the Veterinary inspectors of the powers which have been allotted to them. It is somewhat of a reflection on the way in which the law is carried out in Somersetshire to read that "it is certain that if more herds had been systematically examined many more affected animals would have been discovered"; and these are the words of a very keen medical officer of health who is well-known as a great friend and supporter of the Veterinary profession. Dr. Savage's article, which has by arrangement, also appeared in *The Lancet*, should be as carefully read by the members of our profession who hold appointments under the 1925 Tuberculosis Order, as it has doubtless been read by State officials in human medicine. It is full of fearless criticism and well-worth studious perusal, being summarised by the paragraph which we have purposely italicised on page 235; and Dr. Savage rightly emphasizes (page 236) that "It should be made a duty under the order to report all animals *suspected* to belong to one of the designated groups," and for the controlling of these cases Dr. Savage suggests that Veterinary inspection should be State subsidised and free of charge to the owners.

A distinguished Dutch scientist, Professor Leersum, discusses the subject of Vitamin C in raw and pasteurized milk respectively, and certain members of the profession who were in Holland recently on a conducted tour, will recognise the article as being the substance of a lecture with which Professor Leersum kindly entertained them.

Lt.-Col. Reid, whose life has been largely spent in Government Service in New Zealand, writes upon the dairy industry in that country.

The whole time county inspector's aspect of the question is clearly put forward by the Chief Veterinary Inspector for Glamorganshire (Capt. Howard Jones), and we trust that after a careful reading of the April and May numbers our readers will have gained valuable and useful knowledge which will serve them in good stead when called upon to carry out the law and to advise their clientele.

General Articles

BOVINE TUBERCULOSIS AND THE TUBERCULOSIS ORDER, 1925.

By WILLIAM G. SAVAGE, B.Sc., M.D.Lond., D.P.H.,
Medical Officer of Health for the County of Somerset.

The evidence is conclusive that a material proportion of human tuberculosis is of bovine origin, due to the consumption of cows' milk containing living tubercle bacilli. Any measures in force for controlling and diminishing the amount of bovine tuberculosis must therefore be of interest and practical concern to those engaged in public health. The Tuberculosis Order has been advocated and recommended, not only as a valuable agent for the diminution of bovine tuberculosis, but also as an important means of reducing the dangers from tuberculous milk. It is necessary to study with care the actual working of this Order, and to try to ascertain how far it is likely to reduce the danger of milk acting as a vehicle for the conveyance of tuberculosis. With this object I have made a careful study of its working in a very large dairy county for the 16 months of its operation to the end of 1926. I have no reason to believe that the procedure in this county differs in any essentials from the practice all over England, while in many ways its administration must be regarded as on a high level, as regards the care with which different requirements are carried out.

The Theoretical Aims of the Order.

It is admittedly impracticable to slaughter all cattle suffering from tuberculosis. The Order does aim, however, at reducing infection and so diminishing the amount of tuberculosis. It is a development of the method advocated by Prof. Ostertag, of Berlin, of the elimination of all " open " cases of tuberculosis from dairy herds. In his method this was attained by periodical examinations of the herds by veterinary inspectors, together with bacteriological examination of the mixed milk. If tubercle bacilli were found in the milk, or if suspicious animals are clinically detected, veterinary and bacteriological examinations are again made of these animals. The animals with " open " tuberculosis are slaughtered, while the premises are thoroughly disinfected. This complete plan is not followed, but in the words of the circular of the Board of Agriculture—

> The Order aims at the destruction of every cow suffering from tuberculosis of the udder or giving tuberculous milk, and every bovine animal suffering from tuberculous emaciation or suffering from a chronic cough and showing definite clinical signs of tuberculosis.

Three types of tuberculosis are scheduled, i.e.—

> (1) Any cow which is, or appears to be, suffering from tuberculosis of the udder, indurated udder, or other chronic disease of the udder.

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(2) Any bovine animal which is, or appears to be, suffering from tuberculous emaciation.

(3) Any bovine animal which is suffering from a chronic cough and showing definite clinical signs of tuberculosis.

These three types may conveniently be called the designated types of tuberculosis. The knowledge of these animals administratively is obtained from two sources, i.e.—

(1) Every person in charge of an animal which may be suffering from one of the designated types of tuberculosis has, without unavoidable delay, to give information of the fact to a police-constable or to an inspector of the local authority.

(2) A veterinary surgeon who, in his private practice, comes across such an animal has to notify it to an inspector of the local authority.

The Order provides for examination of these notified animals by a veterinary inspector appointed by the local authority, for their slaughter if considered to be in one of the three designated groups, with compensation to the owner according to a definite scale. The local authority referred to is the local authority under the Diseases of Animals Act, 1894.

To estimate the efficiency of the Order as an agency to reduce bovine tuberculosis, certain points are obviously of fundamental importance.

The Stage at which the Three Specified Classes of Tuberculous Animals are Notified and Destroyed.

These cases of advanced tuberculosis are a great danger to the rest of the herd, since they eliminate tubercle bacilli in their expectoration and in their fæces. Ostertag's procedure has a definite scientific aim—i.e., to detect these animals by the aid of bacteriology and veterinary examinations within a short time of their becoming "open" cases. The Tuberculosis Order does not make use of these aids, but relies on a system of notification by owners and veterinary surgeons. In this country it is not the practice of farmers and breeders to have systematic veterinary inspection of their bovines, but only to call in a veterinary surgeon when an animal is definitely ill. Only a small proportion of animals in the designated classes are likely therefore to be notified in this way. Of the 798 animals dealt with to the end of 1926, only 172 were reported by veterinary surgeons, and this number includes those found when inspecting herds containing a notified animal, while 612 were reported by owners, the remaining 14 being otherwise reported. In practice the onus of reporting these designated animals is mainly thrown upon the owners. The average farmer is very ill-informed in regard to tuberculosis, which cases are dangerous, and how it is spread. Tuberculosis of the udder is difficult to diagnose except when advanced. He has not to report emaciation, but only an

animal which " appears to be suffering from *tuberculous* emaciation " ; he has not to report a chronic cough, but only an animal which is " suffering from a chronic cough *and* showing definite clinical signs of tuberculosis." He is under no obligation to call in veterinary assistance if he suspects, and obviously he can leave any notification until any animal is of no further use to him without the slightest risk of incurring any penalty.

Theoretical considerations suggest, therefore, that the bulk of the animals are only likely to be reported after the condition has existed for a long time, and after the animal has been an active spreader of infection. This is amply substantiated when an analysis is made of the returns.

The 798 cases were as follows :—

Classed as " advanced " tuberculosis	496
,, " not advanced " ,, ...	284
,, udder tuberculosis (entirely or mainly)	13
No tuberculosis at post-mortem	5

A number of the " advanced " and " not advanced " groups showed udder lesions, and this point is dealt with below, in addition to other lesions of tuberculosis.

It must be noted that " not advanced " under this Order does not mean what it would do in a medical diagnosis. An animal can have extensive and old-standing lesions and still be classed as " not advanced." The following are examples of post-mortem records of cases classified as " not advanced "—

Tuberculosis of the lungs, pharyngeal, mediastinal, and mesenteric glands.
,, ,, mesenteric glands, intestines, and several joints.
,, ,, both lungs and miliary tuberculosis of the liver.
,, ,, the intestines and of the bronchial glands.
,, ,, the lungs, pleura, and mesenteric glands.

Section 9 (4) of the Order defines the conditions to be included as " advanced " tuberculosis. It is evident that a good many of the cases which were passed as " not advanced " in my summary under this definition belong to the advanced group, and if correctly placed would have sent still higher the percentage of advanced. It is perfectly clear from the above figures and a study of the post-mortem returns that a preponderating proportion of the cases are old long-standing cases, most of which have been excreting tubercle bacilli for a long time before their slaughter under the Order. A single example may be quoted, and it refers to an animal killed December, 1926—i.e., after the Order had been in operation for nearly 16 months. The post-mortem record reads :—

" Generalised tuberculosis : tuberculosis of liver, kidney, pleura, intestines, miliary tuberculosis of both lungs, sub-maxillary, parotid,

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pulmonary, bronchial and hepatic glands tuberculous. No tuberculosis of the udder."

The Extent to which the other Animals are Examined in a Herd found to contain a Positive Notified Case of Open Tuberculosis.

The Ministry of Agriculture and Fisheries emphasise the importance of this in Circular Letter No. 13 (July, 1925), and point out :—

"Where the report has been received in respect of a particular animal, the examination conducted by the veterinary inspector should not be confined to the animal which was the subject of the report, but should be extended to other bovine animals on the premises, and particularly to all milch cows, and the veterinary inspectors should make an exhaustive clinical examination of any animal which there is reason to suspect of suffering from tuberculosis of the udder, from tuberculous emaciation, or of giving tuberculous milk."

Such an investigation is obviously of great importance from the preventive standpoint. There are three different attitudes. One is the wording of the Order itself which is non-committal and leaves it entirely to the veterinary inspector to examine any other animals on the premises which he "considers it desirable to examine." The second is the wholly admirable urge of the Ministry of Agriculture, quoted above, to investigate the other animals for sources of tuberculous infection. The third attitude is that of the local authorities administering the Order which, so far as I can ascertain, is generally in the direction of strongly discouraging any detailed examinations of the other animals. I have been told by responsible veterinary inspectors in other areas that they have been definitely instructed not to examine the other animals except under special circumstances.

In the county under consideration it is evident that only in a quite small minority of cases are the other animals examined. This is shown by three sets of facts. In the first place, an examination of the actual returns shows that it is quite the exception to examine the other animals, although a place is provided for this information. The records are badly kept as regards this point, so exact statistics cannot be given, but even giving the credit to doubtful cases, the total of herds examined is a very small proportion of the whole. The usual plan seems to be to ask the farmer if he has any doubtful animals, and to look at these, while in some cases the animals are paraded for the inspector, but clearly this is not in any sense an examination.

In the second place the extra fees paid out to veterinary surgeons for these secondary examinations amount to a very small amount during the 16 months, and afford definite evidence of active discouragement.

The third fact is the number of cases in which the examination of

the other animals has resulted in the detection of an animal suffering from one of the designated types of tuberculosis. During the whole 16 months only 24 such positive cases were reported. Some of these were after an examination of all the bovines, or at least of all the cows, but in a good many cases they were individual suspected animals brought forward or picked out without an examination of the whole herd. The primary animal causing the Veterinary Inspector to visit was either an animal suffering from emaciation or chronic cough, none from tuberculosis of the udder. Most were single cases, but three were on one farm, and two were reported from each of two farms—i.e., they were from 20 herds. These 24 animals were :—

8 cases of advanced tuberculosis } with no mention of udder involvement.
7 ,, not advanced ,, }
5 ,, advanced ,, with definite udder tuberculosis.
4 ,, udder tuberculosis (alone or mainly).

It is certain that if more herds had been systematically examined many more affected animals would have been discovered. One example of what happens may be quoted. An emaciated animal was slaughtered, November, 1926, and showed *post-mortem* very advanced tuberculosis, the following being mentioned as tuberculous, both lungs, pleura, peritoneum, liver, spleen, intestines, and mesentery. There were 50 cows and 30 bovines on this farm, yet none were examined although, obviously, this animal must have been actively infectious for a long period.

The Extent to which "Udder" Tuberculosis is being Notified.

The records show that the 798 cases reported were for the following conditions :—

Tuberculous emaciation or chronic cough ... ... = 738
Udder tuberculosis ... ... = 60

The udder notifications were fairly uniformly distributed in time, since the notifications in the four four-monthly periods from Sept. 1st, 1926, to the end of 1926 were respectively 15, 15, 14, 16. There is therefore no evidence that cases are being reported more frequently as the Order becomes better known. The *post-mortem* findings in these 60 cases were :—

"Advanced" tuberculosis, with udder involvement as part of the general tuberculosis ... ... = 33
Considerable lesions in other organs as well as the udder but classed as "not advanced" ... ... = 9
Udder lesions only reported ... ... = 13
No tuberculosis of the udder ... ... = 5

These findings are of considerable interest. They show only 13 cases of udder tuberculosis alone, while in 42 the udder involvement was merely part of a general tuberculous infection.

While 60 out of 798 cases (7·5 per cent.) seems a fair proportion, other facts have to be considered. In five cases the swollen or indurated udder which led to the primary notification was found *post mortem* not to be due to tuberculosis. Four of these were "advanced" tuberculosis without udder lesions, the fifth animal showed no tuberculosis anywhere. Three cases were not primary notifications under the Order, but were detected by the examination of cows in the notified herd. Three other cases were discovered in connection with inspections under the Milk and Dairies Act, 1915—i.e., from the examination of herds the milk from which was found to contain tubercle bacilli. They were subsequently dealt with under the Tuberculosis Order as a matter of policy and so become included. They cannot properly be included as notifications made in connection with the working of the Order. The exclusion of these 11 cases leaves only 49 cases of udder tuberculosis which were reported under the Order. In no less than 33 of these the udder lesions were a more or less accidental concomitant of a state of advanced tuberculosis for which the animals were dealt with. We are left with only 10 cases of primary udder tuberculosis reported as primary notifications under the Order. It cannot be contended from these figures that the Order is doing anything material to eliminate cows suffering from primary udder tuberculosis.

There are some 100,000 cows in the county, and if the proportion of udder tuberculosis is taken as 0·3 per cent. (which is well below the figures of most veterinary authorities) this gives about 300 cows as suffering at any one time form tuberculosis of the udder. This includes primary udder tuberculosis and cases in which udder disease is part of a general tuberculosis. I have examined the *post-mortem* records of the whole of the 798 animals slaughtered under the Order to the end of 1926. It is probable that udder disease is not investigated in cases with conspicuous lesions elsewhere, but since March, 1926, veterinary inspectors have been specially asked to investigate and record this point. In the later schedules udder disease, positive or negative, is specially mentioned in a material proportion of the cases. The following table shows, therefore, the figures recorded separately for the first six months and the last nine months.

Dealing only with the figures for the last nine months of 1926, they show that out of 451 cases there were 85 cases of udder involvement—*i.e.*, 18·8 per cent. The animals slaughtered include all bovines, and therefore a proportion are not females. If, however, only the figures with definite information supplied as to the condition of the udder are considered, they show that out of 302 cases there was udder involvement in 85 (28 per cent.). A total of 85 cases of udder disease falls very far short of the estimated number of 300,

and it is evident that the majority of cases of udder tuberculosis are not being dealt with under the Order. It must, however, be credited as one satisfactory feature of the Order that during 16 months working 131 cows with definite disease of the udder, the majority of which were supplying milk for human consumption, were destroyed.

THE EXTENT TO WHICH LABORATORY FACILITIES ARE BEING UTILISED TO ASCERTAIN IF SUSPECTED ANIMALS BELONG TO ONE OF THE DESIGNATED TYPES OF TUBERCULOSIS.

Laboratory facilities are provided free of cost, the work being done in the county laboratory. An outfit and all information is sent on request. Out of the whole 798 cases laboratory diagnosis is reported

Post-mortem Findings.	Sept. 1st, 1925, to March 31st, 1926.	Last 9 months of 1926.	Total.
" Advanced "—			
Condition of udder not mentioned	177	113	290
Udder mentioned as not involved	—	109	109
With udder involvement	34	63	97
" Not advanced "—			
Condition of udder not mentioned	122	33	155
Udder mentioned as not involved	—	108	108
With udder involvement	4	17	21
Udder tuberculous lesions; mainly or only	8	5	13
Animals not tuberculous	2	3	5
—	347	451	798

as made use of in only 15 instances. Four of these do not properly come under the Order as they were four positive cases detected under the Milk and Dairies Act, 1915, and merely slaughtered under the Order. Excluding these the other cases were :—

In 4 the veterinary surgeon reported he had examined the milk and found tubercle bacilli.

In 1 the veterinary surgeon examined material from a discharging neck gland and found tubercle bacilli.

In 6 cases samples of milk were examined in the county laboratory (5 positive).

These figures show that laboratory diagnosis is hardly being used at all. This is a significant subsidiary proof that it is only advanced cases, easily recognised clinically, which are being dealt with, and that no endeavour is being made to eliminate udder tuberculosis.

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All experienced veterinary surgeons are aware of the need for bacteriological assistance to diagnose early and doubtful cases of udder tuberculosis. I have investigated, accompanied by a veterinary surgeon, a good many herds, the milk from which has yielded tubercle bacilli. Invariably such herds have contained cows which showed mammary abnormalities which the veterinary surgeon was unable to exclude as not tuberculous without a bacteriological investigation of the milk. It is true most of these have been negative bacteriologically, but the fact illustrates the necessity of bacteriological examinations in doubtful cases. I trace part of this neglect of laboratory assistance to the fact that no conference of veterinary surgeons working the Order was ever held, and that no whole-time veterinary officer was appointed to co-ordinate the work.

Disinfection of Premises after "Open" Cases of Tuberculosis have been Destroyed.

The requirements of the Order (Section 13) are very vague, and if disinfection at all is to be carried out or how it is to be done is left to the discretion of the police. Although we may not all agree as to the practical utility of disinfection in such cases, the disinfection of cowsheds is a valuable method of bringing home to the cow-keeper the infectious nature of these open cases and the importance of reducing infection. Personally, I think disinfection is itself a valuable preventive measure if adequately carried out. Disinfection is a scientific matter, and disinfection of cowsheds particularly difficult. One is left wondering what part of the training of the police fits them for the exercise of these functions and without expert guidance. In Somerset I have drawn up a simple procedure for disinfection, and the chief constable has issued instructions for disinfection to be carried out along those lines. This, however, is outside the Order, and there is nothing in the Order suggesting obtaining the advice of an expert or indeed suggesting that disinfection should be generally carried out. I fancy an inquiry as to the procedure followed in different areas would be illuminating.

Summary.

Assuming, as I am compelled to do, that the above account of the actual working methods of this Order are in no way peculiar or abnormal, it gives a clear idea of what it is doing and furnishes a basis on which to frame an opinion as to what it is likely to accomplish. No effective steps are being taken to explain to the owners of the cows the real nature of tuberculosis, the economic importance of eliminating it, the preventive possibilities and aims of the Order, the objective signs in cattle to look out for, or to offer veterinary and laboratory

help to detect these dangerous animals in the early stages of their gross infectivity. Simple and clearly written instructions as to their responsibilities under the Order are not issued. The great bulk of the animals slaughtered under it are destroyed only after they have been highly infective for a long antecedent period, and after they have had prolonged opportunities to infect the other animals in the herd and the byres. They are slaughtered when much of the harm they are going to do has been done. No effective steps are taken to carry out the printed recommendations of the Board of Agriculture in regard to the detailed examination of the other animals in the herd, even when the slaughtered animals are in an advanced stage of tuberculosis, and suffer from such infective conditions as severe chronic cough or diarrhœa. Such disinfection as is practised is in the hands of the police, and is entirely unsupervised by anyone who knows what disinfection means. The elimination of tuberculosis of the udder is, in the main, neglected, and no effective steps are taken to encourage the use of bacteriological methods of diagnosis. The cost of working the Order is considerable both for compensation and administration, and being without any preventive outlook it is difficult to see what is the gain to the community from this heavy expenditure.

Perhaps a clearer appreciation of the futility of the Order, as it is being worked, will be obtained by imagining our preventive work against human tuberculosis carried out along these lines. No steps would be taken to enlighten householders where there was an advanced case of tuberculosis of the dangers of infection to the other inmates or to explain how the disease is spread. No action would be taken to isolate or remove the advanced case until he or she had been actively infectious for a very long period, possibly a year or more. When nearing his end, the case would be removed from the house (the equivalent of slaughter for cows). No steps would be taken to examine the contacts to see if they had tuberculosis, and no advice would be given in regard to them. The police would then be allowed to disinfect according to the ideas of the chief constable, but no officer experienced in disinfection would be permitted to interfere. Finally, the local authority would pay the householder a sum of money because he had had an advanced case of tuberculosis in his house.

It is not the purpose of this paper to discuss the best way to deal with the very difficult problem of bovine tuberculosis. On the other hand, assuming that the principle of working along the lines of the Tuberculosis Order is retained, it is perhaps worth while to indicate certain directions along which, in my opinion, its working might be improved.

Tuberculosis is a cause of enormous financial loss to the farmer, breeder, and butcher. Authorities agree that, quite apart from any question of human infection, it is of the highest benefit to agriculture to eliminate it or at least reduce its ravages. Part of the success of methods for the reduction of human tuberculosis undoubtedly are due to the persistent efforts which have been made to enlighten the public as to its methods of spread and the feasibility and importance of prevention. The same policy is necessary as regards bovine tuberculosis. To throw upon the farmer the duty of detecting and notifying such highly technical conditions as tuberculosis of the udder, tuberculous emaciation, and chronic cough, accompanied by definite clinical signs of tuberculosis without giving him advice or guidance can end in nothing but the notification of animals in a highly advanced condition, and after they have spread much infective material. My figures show that more than three-quarters of the notifications were directly made by the owners. I am aware that agriculturalists can obtain excellent leaflets from the Board of Agriculture on many subjects, including tuberculosis, but I am unaware of any systematic educational efforts being carried out along the lines I have indicated.

Such educational efforts cannot teach the owners of herds how to diagnose tuberculosis, and this alone is not enough. They must be made interested and brought to realise that the presence of these "open" cases is a direct menace to the healthiness of their herds, and that it is financially to their advantage to eliminate them as soon as possible. It should be made a duty under the Order to report all animals *suspected* to belong to one of the designated groups. To be effective, this must go hand in hand with the education just mentioned as to the financial advantage of eliminating these animals. The local authority should provide veterinary assistance, free of charge, to ascertain if these suspected animals did come under the Order. As a natural corollary any owner found to have an animal in an advanced stage of tuberculosis which he should have and did not report as a suspected animal would be fined, and no compensation paid for slaughter. This would increase his interest in the problem. The benefit of free veterinary assistance for suspected animals would be of great assistance to owners of herds, and only the neglectful indifferent farmer would be penalised. It would prevent some of the scandals which occur at present of cows being deliberately milked to the bitter end, although clearly in an advanced stage of tuberculosis, and then when no longer of use as milkers, being reported and compensation claimed.

A system of regular veterinary inspection of dairy cows is obviously a much better procedure than the above as a means of reducing

tuberculosis, but the cost is prohibitive if done adequately. As a step towards this goal, and one costing very much less money, is the examination of suspected animals. When a veterinary surgeon is on a farm examining a notified animal it does not take long to examine the other animals, and it should be done as a routine measure. It should not be left to the discretion of the veterinary inspector, since when the local authority paying him his fees discourages such examinations it puts him in a highly invidious position. It should be a duty, and a proper entry should be made on his return giving the number of bovines examined and stating definitely that in his opinion none of which come under the designated groups, and giving particulars of those which are suspicious. In view of the difficulty of the diagnosis of udder tuberculosis in its early stages, there is need to encourage and facilitate a much greater use of bacteriology as an aid. I am decidedly of opinion that these examinations should be carried out by a competent bacteriologist in a properly equipped laboratory.

The whole question of the administration of this Order needs revision. From communications from other county medical officers it is evident that in most counties it is administered by the Agricultural Committee, and without any liaison with the Public Health Committee or its medical officer of health. The general procedure seems to be to carry it out by means of part-time veterinary surgeons and without any controlling expert. There is no expert to attend the committee and advise as to the proper way to work the Order. There is no expert to see that the details of the Order are carried out as they should be. In some places the chief constable seems to be the controlling official. The inevitable result is that its preventive possibilities are overlooked, and the Order is looked upon as something to be worked as economically as possible, and administrative endeavour is turned to the reduction of the cost of its working. To be of any lasting value the Order must be worked on preventive lines with a preventive outlook, and this means the guidance of an expert in preventive work. To do so means a much greater expenditure in the earlier years, but one which ought to steadily diminish. (I pointed this out in 1913 in connection with the Tuberculosis Order, 1913.) The present procedure means a heavy expenditure which is not likely to show any material diminution year by year, since I cannot see that any prevention of tuberculosis is likely to result. To spend more money initially and do real preventive work is much sounder economy than to cut down costs to the lowest possible, and as a result waste all the money as regards doing anything to reduce the spread of infection.

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Improvements are also necessary on the technical side. For reasons somewhat similar to those which make whole-time medical officers of health more effective and untrammelled than part-time medical officers, whole-time veterinary inspectors to work the Order are to be preferred. Financial considerations do not make this practicable in most counties at the present time. I regard it as essential however, that each county of any size should have at least one whole-time veterinary surgeon on its staff. He would be the expert official who would advise the Agriculture Committee in regard to the working of the Order, and who would control the work of the part-time men and unify their practices. He would also be able to carry out a number of the examinations himself. Under the Milk and Dairies (Consolidation) Act, 1915, and the Milk and Dairies Order, 1926, the county councils have considerable duties and powers with regard to the inspection and examination of cows, and these would be carried out by this whole-time officer. These powers are worked by the Public Health Committees, and this Officer should be on the staff of the county medical officer of health and under the Public Health Committee. This would ensure that co-ordination of effort which is so lacking at present, and would help to give the preventive outlook to the working of the Tuberculosis Order, 1925.

Assuming the continuance of the principles of the Tuberculosis Order as the official method of reducing tuberculosis, I submit that unless a radical change of procedure is instituted very little will be accomplished in the way of reducing bovine tuberculosis; indeed, it is likely to do harm, since the money available for tuberculosis prevention and reduction is limited. To drain it away along a channel which has little or no preventive prospects will prevent it being applied in directions where it might be beneficial.

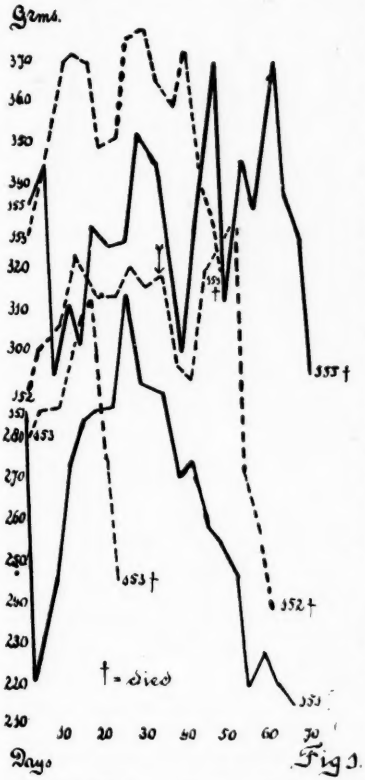
VITAMIN C CONTENT IN RAW, AND IN PASTEURIZED, MILK.

By Professor E. C. van LEERSUM, M.D.,
Director of the Netherland Institute of Nutrition, Amsterdam.

An objection often raised to the pasteurization of milk is that the heat destroys the vitamins. If, however, the milk is examined before being pasteurized, it will appear that it has then already lost its vitamins to a considerable degree.

I examined ordinary raw milk and found in it much less vitamin C than there might be expected to be in good fresh milk. It was milk such as is sold by the milkmen in Amsterdam, got from the cows in the afternoon and not brought into town till the next morning, so that it is of about 16 hours standing, and therefore by no means

fresh. Six guinea-pigs which had been put on the usual scorbutic diet and, as the source of the anti-scorbutic factor, got only this raw milk (either daily 50 c.c., or else 30 c.c., per 100 grams body weight), all died with symptoms of sub-acute scurvy, which diagnosis was confirmed by a microscopic examination of the ribs, femur, tibia, adrenals and bladder. The curves of their weight (see Fig. 1) show that none of these animals survived more than 75 days. This proves that not all vitamin C was lost, for then the animals would have died much sooner, but that the content was not so large as it had originally been appeared from a comparison with a raw pure (Grade A, tuberculin tested) milk, from the model farm, "Oud Bussem" (near Amsterdam). Control tests had shown that 50-75 c.c. of this raw milk daily was enough to prevent guinea-pigs getting scurvy. Six guinea-pigs who had been fed on this excellent milk, in addition to their vitamin C-free diet, remained (as was to be expected) in perfect health. When this milk was replaced by the ordinary raw milk mentioned above the animals visibly declined and either died of sub-acute scurvy or proved to have suffered from this disease after they were killed (see Fig. 2).



Guinea Pigs on Basal ration plus ordinary milk. 30 c.c. on 100 g. body weight.

This Grade A milk, it should be noted, was as fresh as milk brought into town from outside can possibly be. The milking takes place early in the morning and the milk is sold in town as early as nine o'clock so that no more than five or six hours have elapsed. The tests were made in summer, both kinds of milk were from grazing cattle, so that the difference in vitamin content cannot have been due to the food, but must have been owing to the handling of the milk and the degree of freshness.

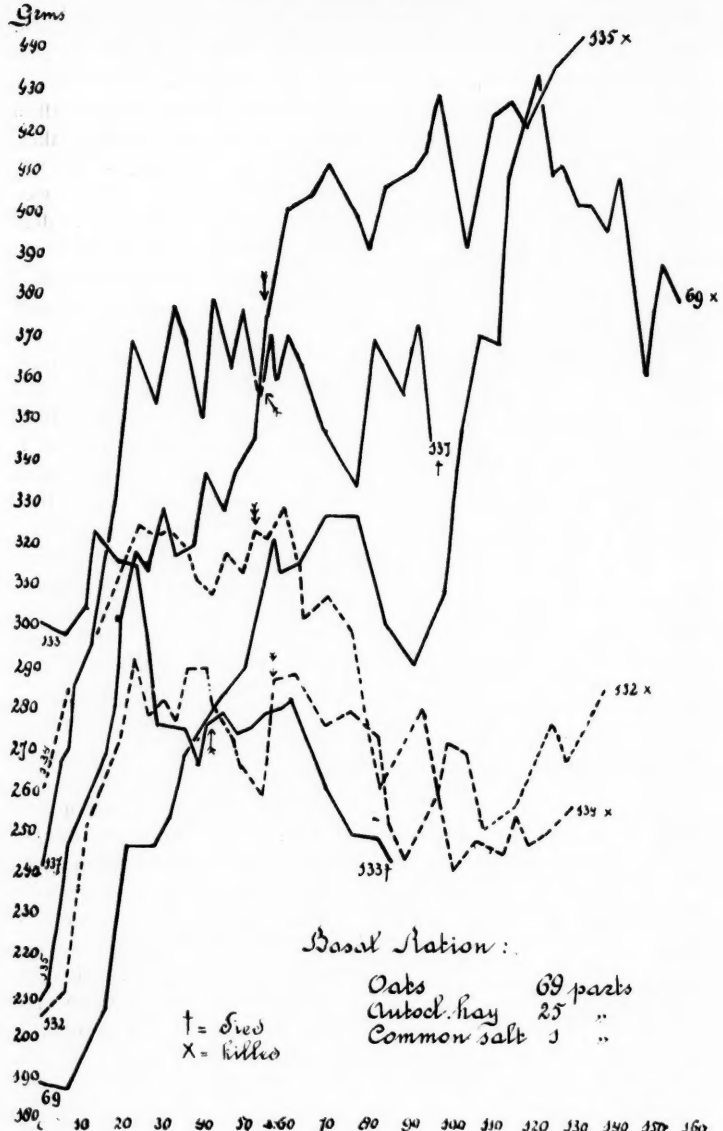


Fig 2.

Guinea Pigs on Basal ration plus pure milk.
Pigs 69, 132, 133, 134 50 c.c.
Pigs 135, 137 75 c.c.

At ↓ substituted by ordinary milk.

It is striking how constantly milk is exposed to the open air. To begin with, the distance between the udder and the pail is a long one; then, in the farm, it is poured into tubs, in which it is carried, often on uneven roads, to the factory. As a rule these tubs are not filled to the brim, so that, during the transit, the milk is thoroughly shaken and mixed with air. In the factory there is more splashing; then the milk is heated once or twice and the cooling is done in such a way that more air can be absorbed; it is also made to flow *over* a cooler. In the bottles in which it is distributed there are always some ccm. of air, and, as it often remains in these bottles for several hours before it is used, there is, here too, plenty of opportunity for it to remain saturated with air.

Kohman* found, in milk brought to a factory for pasteurization, a considerable amount of gas, as much as 18 c.c. a litre, 17·6 per cent. of which was oxygen. In the same milk he found, after pasteurization, still 12·9 c.c. of gas a litre, 15·5 per cent. of which was oxygen.

We found in samples of the ordinary raw milk, such as were used for the first of our experiments, 14·1 and 19·4, and 21·4 c.c. a litre (at 0° C. and 760 mm. Hg.); the proportion of oxygen was greater than that found by Kohman, namely, in one case 23·1 vol. per cent. to 76·9 vol. per cent. nitrogen in another 27·4 vol. per cent. oxygen to 72·5 vol. per cent. nitrogen. In pasteurized milk we found once 17 c.c. of gas a litre, and another time 17·9 c.c., and in the Grade A milk 28 c.c. and 28·5 c.c.

That the composition of the gas found in milk is not similar to that of the air is due to the inequality of the power of absorption of water for different gases.†

If we consider that the vitamins, at least the growth promoting A, and the anti-scorbutic factor C, are very oxidizable (as Hopkins, Drummond, Zilva, La Mer, Kohman and others have shown), we feel convinced that the presence of oxygen in milk cannot be immaterial to the content of these vitamins. To prove this we saturated our Grade A milk with air by blowing air through it at temperatures of 0°, 37° and 65° C. for an hour and then fed a number of guinea-pigs on the scorbutic diet (see Fig. 3) with this milk in quantities of 50-75 c.c. daily. All these guinea-pigs, 14 in number, died within a certain time of scurvy, sooner in proportion as the temperature, at which the saturation had taken place, had been higher.

Milk Saturated at	65° C.	37° C.	0° C.
Number of Test Days (on an average)	23	38	48

* Industr. v. Engin. Chem. 15, 1923, 237.

† See Winkler in Landolt-Bornstein, Physih. Chem. Tab. 1923, 1, 766.

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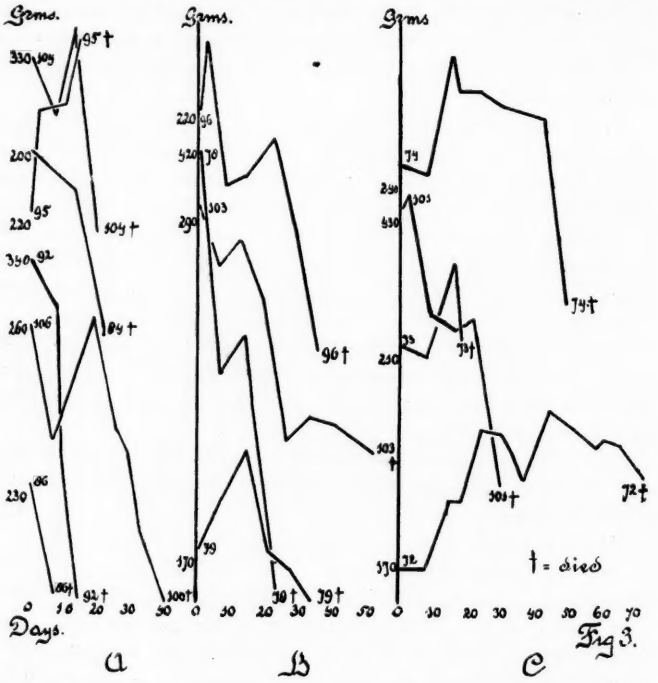
The difference is remarkable. The injurious effect of heat is evident, but at the same time it appears that cooling could not entirely prevent the destruction of vitamin C, though this destruction took place more slowly. For those who think chemically and have acquainted themselves with the experiments above referred to by Hopkins and others, the results of these tests will not be unexpected. The oxygen appears to be the real culprit, the action of heat is but secondary. Heat hastens oxidation, as it generally hastens chemical processes, but



Basal ration plus pure milk. A—treated with air at 65 centigrades.
B—treated with air at 37 centigrades. C—treated with air at 0 centigrades.

by itself, apart from oxygen, it would not injure the vitamins. Nor will it cause suprise that after pasteurization nothing remains of the small amount of vitamin C in milk not fresh. A test of a pasteurized milk, that is milk at least 16 hours old before being pasteurized, proved this. The guinea-pigs (see Fig. 4) died within four weeks of acute scurvy.

Opinions differ with regard to the desirability of preserving the vitamins in milk. It has been asserted that milk, as a source of

vitamins, is not indispensable, as they are found in so many other foodstuffs. This may be true for those who need not be contented with food of inferior quality, with preserved and artificial food, such as unpolished rice, barley and margarine, but can eat their fill of fruit and fresh vegetables. But to a great many people it does not apply. It is certainly in the interest of those to be careful of the vitamins that are to be found in cheap food, and not wilfully destroy them. Besides, there are many large groups of the population who need fresh milk of good quality and undiminished nutritive value. In the first place the nursling who has to do without the mother's milk; secondly, the growing child; and further the sick, the weak and convalescent, the pregnant and suckling mothers. All these make, or ought to make, a plentiful use of milk, and it is desirable for them that the original content of food factors in milk, in other words its full nutritive value, should be preserved. For healthy grown-ups, many of whom rarely take milk beyond a few drops in their tea and coffee and some in the preparation of their food, it does not matter much if it contains hardly any vitamins, but for those other groups it is of great importance to get an unadulterated product, not bereft of any of its natural elements, and so clean as not to be detrimental to health, when taken raw. Till recently such milk was scarce, because, on account of the great expense of its production and the consequent high price, the producer could not count on many customers. It is certainly no small merit of Prof. Stenhouse Williams, and Capt. Golding, of the Institute for Research in Dairying, at Reading, to have proved that clean milk, with a very low percentage of bacteria and without pathogenic microbes, can be produced and supplied at small cost, so that also those who are not rich can buy it. It is no more necessary for the production of clean milk that the stables should be luxurious than it is needful for the surgeon—who has known long since that infection as a rule is caused by contact—to have an expensively appointed operating room, provided he has good assistants at his disposal. The surgeon at the Front during war time and the

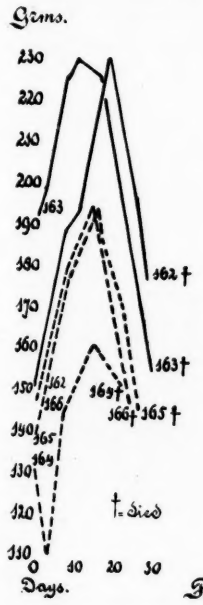


Fig 4.

Guinea Pigs on Basal ration plus pasteurized milk. 30 c.c. on 100 g. body weight.

country doctor, manage to do their work under very unfavourable circumstances, in the same way Stenhouse Williams proved it possible to obtain clean milk in an old tumbledown barn. But as it will be long before the strict rules of hygiene are everywhere obeyed in the dairying industry, it remains as yet necessary to disinfect and preserve the milk destined for the general public. This, however, ought to be done in such a way that the original nutritive value of the milk is preserved. Seeing that it is apparent that oxygen is injurious to certain important elements of milk, it is needful to prevent as much as possible its contact with air. One of the best measures to ensure this is to see that the milk used for pasteurization is as fresh as possible, therefore the carrying to the factory ought to be done very quickly. Other measures to be recommended are the use of the milking machine which operates with a vacuum, the filling to the brim of the transportation vessels, careful cooling, the substitution of a cooler in which the milk flows *through* tubes cooled from the outside for that of Lawrence, and the avoidance of all unnecessary pouring and splashing, all which measures should be adopted as they are also to be recommended from the bacteriological standpoint.

THE DAIRY INDUSTRY IN NEW ZEALAND.

By H. A. REID, O.B.E., F.R.C.V.S., D.V.H., F.R.S.E.,
late Veterinary Bacteriologist to the Government of New Zealand.

NEW ZEALAND is fast becoming the most highly productive dairying country in the British Empire. Already Britain receives from New Zealand butter and cheese to the value of nearly £19,000,000. About 23 per cent. of the total overseas supplies of butter sent to the United Kingdom comes from New Zealand, and one half of the cheese.

To those familiar with the natural resources of the country, the reasons for this unparalleled prosperity are not difficult to seek. In fact these may be briefly summed up in the one word—climate. The climate of New Zealand is admirably adapted to the breeding and rearing of dairy stock. The country is well watered, and generally speaking, has an ample rainfall over the greater part of the year. The winter months, though sometimes rendered disagreeable owing to the long periods of wet weather, are characterised by a temperateness in comparison with that prevailing in Northern Europe. Grass tends to grow continuously throughout the year. Even in the south, where the winters are more severe, it suffers only a slight seasonal check. In consequence, it is possible to graze cattle all the year round. Beyond the provision of flannel lined, canvas covers which are extensively and most advantageously used as a protection at night, dairy cows are never housed except during milking hours.

Contrasted with the short grazing season of May to October in Britain, the New Zealand farmer is given a remarkable advantage over the home producer. The only provision he need make, and this unfortunately, is not always adequately recognised, is to supplement the natural feed during the period of shortage in winter by an allowance of hay, straw, and roots. Cake is seldom or never used, except in the case of pedigree or show stock. A common and too prevalent practice is to allow the stock access to straw stacks—a most wasteful procedure frequently resulting in more straw being blown and trampled in the mud than is consumed.

But in all criticisms of New Zealand farming methods it should be borne in mind that labour and all it stands for is the greatest obstacle

Farm Buildings.

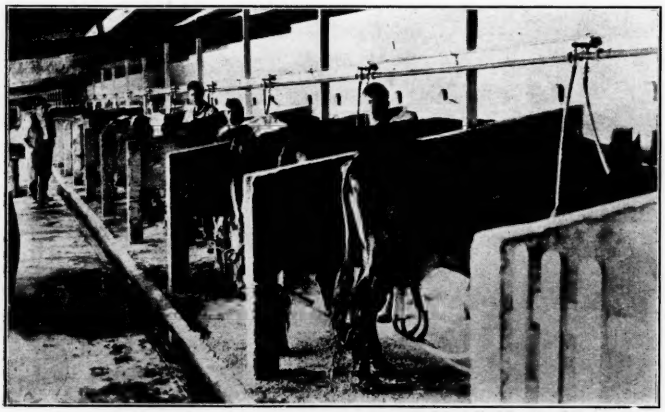
to progress. The New Zealand farmer, compelled by circumstances to work short handed, has not the opportunity to bestow the time and attention required by methods which in older and more populated countries are matters of time-honoured routine. His methods must conform to his environment, and may in consequence, often be of a rough and ready nature ; not because he does not know better, but because circumstances prevent him from doing better.

Needless to add that on account of the difficulties referred to, machines are almost exclusively employed for milking operations. Stripping by hand is carried out where possible.

But although the New Zealand dairy farmer has much to contend with on account of scarcity and dearness of labour, he receives much valuable assistance in other directions from the State, and through

the system under which the dairy industry is developed and carried on. Dairying in New Zealand is conducted on a co-operative basis. Local companies, financed by capital subscribed by those engaged in the industry, aided as a rule by a Government loan on mortgage at five per cent., are established in suppliers' districts.

The daily supplies of milk brought to the factory by farmers in the vicinity are weighed and tested for butter fat content. The suppliers are credited with the amount received, and monthly payments by cheque are made. This system is a great boon to many engaged in the industry assuring them of a regular income to meet current expenses. Apart from the financial assistance available from the State, the Government places at the disposal of farmers the advice



Interior of Cowshed. Alfa-Laval Milker at Work.

and services of experts in the shape of veterinarians and dairy instructors.

THE DAIRY INDUSTRY ACT, 1892.

The object of this measure was to regulate the manufacture of dairy produce and to prevent the deceptive branding of butter and cheese. This legislation was amended in 1894, and the Government inspectors were given extended powers to ensure the purity of the milk used. Factories were required to be registered and provision was made for storage in cool stores and for Government grading. Other legislation followed, until finally all was consolidated in 1908 in the Dairy Industry Act, which, in addition to the safeguards regarding the produce mentioned above, gave authority for advances to be made by the State to dairy companies for the purpose of acquiring land, for erecting factories, and for the purchase of machinery. Since

then there has been further amending legislation, all designed to foster and improve the industry. Meanwhile, also, the dairy herds of the Dominion had been undergoing improvement.

In the earliest days, Shorthorn cattle were chiefly in use, but other breeds were introduced from time to time, and to-day herd book societies are established in the Dominion for the Jersey, Friesian, Ayrshire, Milking Shorthorn, and Red Poll breeds.

Regulations under the Act provide for the construction of cow-sheds, dairies, etc., in accordance with conditions prescribed by Government. No license is granted to anyone engaged in the industry unless their premises conform to the standard approved by the Department of Agriculture. Prior to the issue of a license the premises

A Herd at Grass.

must be inspected and certified to by a Government Veterinarian or Inspector of Stock.

GRADING.

The Official Grading System, which has been in existence since the early days of the export industry, is a very rigid one, with the result that the New Zealand Government's Grading Certificate is usually accepted as final in the sale of produce.

The Grading System enables the Department of Agriculture to keep a complete check on the quality of the produce from every factory, and when necessary, immediate investigation is carried out by its officers. If the cause of complaint cannot be traced to the factory, dairy instructors make investigations at the farms supplying the factory. Finally, there is a grading supervision of the butter and cheese when it arrives in Britain by New Zealand Government Experts, who are attached to the office of the High Commissioner.

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Whereas, in 1925, the total exports of butter and cheese from New Zealand reached only 394,284 cwts., in 1924 the shipments aggregated 2,863,941 cwts. Since the war there has been a great development, as the following table shows :—

	1918.	1925.
	Cwts.	Cwts.
Exports of Butter ..	431,000 ..	1,245,000
Exports of Cheese ..	883,000 ..	1,377,000

It is well to explain that, so far as New Zealand is concerned, in reviewing the progress of dairying it is necessary to regard butter and cheese exports conjointly. Under the system which is general in New Zealand, many of the factories have dual plant installed for butter-making and cheese-making, and manufacture can be diverted from one commodity to the other according to the demands of the market. At the present time there are over 500 butter creameries and cheese factories in the Dominion equipped with the finest machinery. Tests are carried out at various stages of manufacture to ensure standardisation of quality, and the utmost cleanliness is observed throughout.

The fact that in one series of the recent experiments regarding the nutritional value of certain foodstuffs conducted on behalf of the Medical Research Council by Dr. H. C. Corry Mann, New Zealand grass fed butter was selected for the test, is a sufficient tribute to its excellence. Probably the influence of the greater amount of sunshine enjoyed in New Zealand has the effect of increasing the vitamins present in the grass and enhances the nutritional properties of the milk from cows grazed under these conditions.

THE DAIRY PRODUCE EXPORT CONTROL ACT.

In 1923 the Dairy Produce Export Control Act came into force. This act is administered by a board composed of Government and producers' representatives. Its function is to control effectively the export, sale, and distribution of New Zealand dairy produce. An agency established under the Act in London keeps the board advised as to current prices, and as to other matters relative to the disposal of New Zealand dairy produce in England or elsewhere.

The Dairy Produce Control Board exercises complete control over the handling, distributing and disposing of New Zealand dairy produce in such a way as to safeguard the interests of producers and to protect them as far as possible against the operations of trade rings and combines who might manipulate the market to their own advantage. The expenses of this administrative control is defrayed out of a levy exacted on New Zealand produce amounting to a sum not exceeding one-eighth of a penny in respect of each pound of butter,

and one-sixteenth of a penny in respect of each pound of cheese exported.

Cattle of New Zealand.

Nearly 80 years ago the first cattle were introduced into New Zealand. These were Shorthorns, and they were followed by Ayrshires, Jerseys, Friesians and Guernseys. Almost every breed is now represented. The latest returns give the number of cows in New Zealand (1925) 3,503,744.

Agricultural and pastoral associations which are established throughout the country, encourage breeders to compete at shows and arouse in every way interest in the production of high-grade utility stock. Within recent years a very marked improvement has taken place in the grading of dairy cattle.

Practically every farmer is alive to the importance of culling out the unprofitable cow and the need for the services of a bull from a strain of proved capacity.

As might be expected, in view of the fact that dairy farming is often undertaken by the emigrant classes who may not, by any means, be to the manner born, there are unfortunate exceptions to this rule, though generally speaking advice and instruction on these important points have not been neglected.

Incidence of Disease.

In a climate which enables stock to lead a perennial existence in the open, New Zealand cattle are probably as healthy or healthier than any in the world.

Tuberculosis is estimated to affect 10 per cent. of cattle throughout the country, but certain districts are singularly free from this disease. In Britain dairy cows are stated to be affected to the extent of 50 per cent. or even more.

Tuberculosis of the udder is comparatively rarely met with, and in consequence New Zealand milk and milk products provide probably a greater safeguard to the consumer than can be offered elsewhere. In a series of 751 consecutive inoculations of guinea-pigs undertaken by the writer using the centrifuged deposits from composite samples of fresh milk obtained from various parts of the country, two cases only (0·26 per cent.) of tuberculosis developed in the inoculated subjects. Actinomycosis of the udder appears to be more prevalent and the two diseases may be confused on clinical examination.

Infectious Abortion and its concomitant sterility are widely prevalent and attended by heavy annual losses. Vaccine therapy has been undertaken in respect to the former complaint, but the results following this line of treatment are very difficult to determine with accuracy.

Mastitis is probably the greatest scourge of the New Zealand dairy farmer. The form most commonly met with is that associated with infection by the *Streptococcus mastitidis*. It is the cause of heavy loss and great anxiety to owners of dairy stock and its economic importance cannot be exaggerated.

With a view to diminishing the incidence of this disease, much work has been undertaken by the Veterinary Division of the Department of Agriculture. Among other measures, vaccines, both prophylactic and curative, have been extensively used, but the results have not been encouraging. Sources of contagion are often difficult to discover, though once the disease makes its appearance it rapidly spreads through the herd. Provision is made in the Regulations under the Dairy Industry Act, for the washing of udders prior to milking. In practice this measure may prove worse than useless on account of the filthy state of the water and cloth employed for the operation. Moreover, exposure to cold winds after washing tends to crack the skin of the teats, rendering them more susceptible to bacterial infection. Probably, when conditions will allow, dry cleaning would yield better practical results.

Parasitic diseases, particularly the various forms of strongylosis, are responsible for a good deal of trouble among young stock in winter and spring especially when owners have neglected to provide adequate supplementary feed. In this connection it is interesting to note that mange does not occur in New Zealand.

In conclusion, I desire to express my thanks to Mr. J. B. Wright, London Manager of the New Zealand Dairy Produce Control Board, for his kind assistance in supplying me with some of the particulars referred to, and the New Zealand Government Office for providing the photographs reproduced in this article.

PROGRESS IN THE PRODUCTION OF CLEAN MILK.

By H. W. STEELE BODGER, M.C., M.R.C.V.S.,
Tamworth.

It has been frequently stated that milk producers as a class are slovenly creatures, incapable of appreciating the importance of, or the necessity for, clean milk.

There are those also who, believing this, endeavour to make the milk cleaner by treating it by heat—*unable to realise that clean milk must be produced clean, otherwise it never can be clean no matter how it be treated.*

There are others again who say—some, indeed, who believe—that farmers cannot afford to produce clean milk; they maintain that the Milk and Dairies Order, 1926, is imposing upon milk producers

an impossible task, involving the expenditure of a huge sum of money upon equipment and structural alterations. *This is all bunkum—there is, it is true, some small percentage of milk producers who lack the intelligence and the initiative ever to produce clean milk, and it is to encourage and protect the majority of milk producers and the whole of the public that legislation has been introduced to eliminate the backsliders.*

The enforcement of the Milk and Dairies Order rests with the local authorities who are in a position to know and appreciate local conditions and difficulties, and a sympathetic administration has been urged by the Minister of Health.

The necessary structural alterations may be summed up in four words: light, ventilation, impervious floor. The two first are usually obtainable with the expenditure of a little energy; a few bricks knocked out of a wall, and a few tiles off the roof will usually meet the case, and often light and ventilation can be combined; gone, I hope, are the days of the " cubic air space " bogey; it is the number of times *per diem* that the air is changed which is so important.

An impervious floor is not obtained without some financial outlay, but when one considers all the attendant difficulties of a bad floor—it takes longer (and more) labour to clean, is more difficult to keep clean, and the cow is also more difficult to keep clean; when one remembers also that a bad floor is one of the best and surest means of spreading and harbouring such disease as T.B., Johne's, Contagious Abortion, etc.; and when one considers the annual loss to dairy farmers in consequence of these diseases—the outlay on an impervious floor is surely a profitable investment for the dairy farmer, if not for the veterinary practitioner.

Nearly all the other requirements of the Milk and Dairies Order are commonsense everyday requirements in the production of a milk fit for human consumption, and at the present time are carried out by a large proportion of milk producers as routine.

Such things as clean milk demonstrations and clean milk competitions have done much to improve the quality of milk. *It is impossible to emphasise too strongly that it is " METHOD " and not " equipment " which is the all-important factor in the production of clean milk.* This is recognised by the Ministry of Health who, on their inspection cards, allocate 400 marks for Method, and only 100 marks for Equipment. *It is the* 101 *little things which are so important in producing clean milk.*

Probably no district produces cleaner milk than that which supplies Birmingham with its milk, and certainly no one has done more to encourage the production of clean milk than has the Midland Counties

Dairy Co. I believe this firm to be the only one in the Kingdom which pays both a clean milk and a butter fat bonus to their producers. This firm have erected in Corporation Street, Birmingham, premises which, for convenience, compactness, and hygienic conditions are an architectural triumph; they receive 5,000 gallons a day. Personal inspection by the general public is generously allowed at any time during working hours and members of the veterinary profession are especially welcomed.

They have a staff trained in milk bacteriology who test the producers' milk for bacterial count, and butter fat contents. At the end of each month the twelve producers with the lowest bacterial count are paid 1d. per gallon extra. The next 24 are paid ½d. a gallon extra. One-tenth of 1d. per one-tenth per cent. butter fat is paid per gallon for milk over three per cent. By this means producers received last year £2,500 in bonuses. The Midland Counties Dairy Co. also pay 3d. a gallon extra to producers of tubercle-free milk holding the Ministry of Health licence. The demand for this milk grows steadily and many farmers are openly, and very many more are secretly, eliminating reactors from their herds.

Until recently only the names of those receiving bonuses were issued monthly to all producers, but now the name of every producer is published in his respective position, and the result will be a marked improvement in the count of those producers who were previously towards the bottom of the list. Also, another improvement has been the recent paying of the bonuses on the coli count instead of the gross bacterial count.

A careful study of the appended lists will show a remarkable improvement in the last five years:—

SUMMARY OF FARMERS' BONUS SYSTEM.

Month	Number of Farmers Under	1922	1923	1924	1925	1926
	Bact. per c.c.					
April	30,000	10 (15%)	38 (43%)	41 (41·4%)	65 (54·6%)	96 (68%)
	200,000	50 (79%)	69 (78%)	86 (86·8%)	103 (86·5%)	133 (94%)
May	30,000	5 (7%)	27 (30·3%)	14 (14%)	64 (50%)	90 (63%)
	200,000	30 (42·8%)	57 (64%)	47 (47%)	94 (72%)	121 (85%)
June	30,000	13 (18%)	30 (33%)	19 (19%)	37 (28%)	83 (59%)
	200,000	32 (45%)	51 (57·6%)	36 (36%)	66 (51%)	115 (82%)

30,000 is the maximum bacterial content per c.c. permissible in the production of "Certified" milk—the highest grade milk in the world.

200,000 is the maximum bacterial content per c.c. permissible in the production of Grade A milk.

The figures in parentheses represent the percentage of senders for that month.

Just over two years ago, Professor J. M. Beattie said that, taking an average of 45 milk samples from Birmingham, Liverpool, Sheffield, Newcastle, and London, the total number of bacteria per cubic centimetre was 20,000,000, the lowest number being 19,000 in a sample from Birmingham, and the highest 365,000,000 in a London sample.

Undoubtedly the milk of the future—the milk to strive to obtain—is a clean tubercle free milk, and I for one am convinced that this is an economic proposition with great possibilities for milk producers and milk distributors if only they will work in co-operation one with the other.

To Dr. Stenhouse Williams and his band of workers the public of this country owe a deep debt of gratitude; they have proved incontestably that clean milk is a question of method, not money, and by their help and advice to milk producers they have undoubtedly reduced the infantile mortality of this country.

A VETERINARY INSPECTOR'S ASPECT OF THE MILK LEGISLATION NOW IN FORCE.

By J. HOWARD JONES, O.B.E., M.R.C.V.S.,
Chief Veterinary Officer to the County of Glamorgan.

GRANTED the dire need that has and does exist for legislation compelling conditions and surroundings whereby milk shall be produced under hygienic principles and by cleanly methods, one rather questions whether, in the administration and execution of the Milk and Dairies Order, 1926, the more important necessity for the production of milk from cows with a clinical freedom from disease may not be given a back seat.

I would desire to have pointed out to all Health Authorities that it is a great deal more vital to Public Health that milk should be found to be free from the bacillus of tuberculosis as a primary safeguard, than for even a trace of that germ to be found to be present in a milk which may be most exemplary from the "bacterial count" or "coli-content" viewpoint.

The above remarks are based upon considerable experience in the detection of tuberculosis of the udder in dairy herds; frequently upon premises where the attempts to produce a "clean" milk were of a high standard, and where the producers were persons who prided themselves upon the quality or even the pedigree of their stock and their methods of milk production.

In support of my contention I would place a few authentic instances *of the cowkeepers' failures* to recognise the most dangerous form of the disease, as they illustrate the necessity for expert examination by the qualified Veterinary Surgeon.

Quite recently a sample of milk was found to be infected with tuberculosis upon guinea-pig inoculation. Upon visiting the farm upon which the sampled milk had been produced, the Veterinary Inspector was surprised to find that the farmer was, at that moment, reporting a case of suspected tuberculosis to a police officer. He expressed the hope that, for the farmer's sake, the animal then being reported would prove to be the one that was infecting the milk which had been found tuberculous.

Upon examination of the herd, however, the Veterinary Inspector immediately picked out the animal that was the subject of the owner's report and remarked that unfortunately this was not the animal he was looking for, since this cow showed evidence of having been dry for a considerable time and could not have been milking on the date the sample had been taken. This was thereupon readily admitted by the owner.

A scrutiny of the whole herd was then undertaken, commencing with a superficial glance at all the cows' udders.

A typical dairy cow, in nice condition, attracted the inspector's notice and this animal was quietly handled. The owner remarked, "Yes, sir, I see you know a good cow when you see her. That is one of the best cows I have ever owned. You just examine her milking record here. She is giving me six gallons a day, calved about 10 weeks ago and no one but myself is allowed to milk or touch her. She's a real beauty."

The Veterinary Inspector was by this time examining the cow's udder. He found that one hindquarter, whilst perfectly cool, was, more particularly in the upper half, slightly enlarged and rather definitely indurated when compared with the other hindquarter. The remainder of the herd then having been examined, the inspector remarked that he was very sorry, but the cow he suspected was undoubtedly the best one of the herd. The owner was amazed and took a considerable amount of convincing that the cow's two hindquarters were dissimilar, and, to prove the inspector's fallacy, he milked the disputed quarter to show how perfect the milk appeared.

Microscopic examination of milk from this quarter showed the presence of numerous tubercle bacilli and the cow was slaughtered under the Tuberculosis Order. The owner, still dubious, was persuaded to attend the *post-mortem* examination, and, after being shown a large number of absolutely calcified mesenteric glands, tuberculous lesions in the liver and lungs, he held out his hand saying that he had not believed the inspector's diagnosis, would he now make periodical inspections of his herd, as he had no desire to sell anything but the

purest of milk and confessed that he did not recognise tuberculosis of the udder, at any rate, in its earlier stages.

I would point out here one fact that is of the greatest importance to Public Health. The sample of milk found to have been infective was a mixed sample, containing the milk of 17 other cows, so that it is not the one affected cow's milk alone that is conveying disease germs, but all those whose milk that it is mixed with. Perhaps this has also its beneficial side, since it does ensure that no one consumer is being supplied with an undiluted affected cow's product.

The foregoing case is most unfortunately in my experience a typical one, and that on account of the following data :—

That the cow-owner or milk-producer seldom recognises this form of the disease because of the characteristics of this abnormality, which I append according to my personal observation of numerous cases.

1.—The insidious nature of tuberculosis of the udder in its manifestation.

2.—The fact that most other abnormalities of the udder are attended or heralded by—(*a*) Heat, (*b*) Pain, (*c*) Swelling (sudden), (*d*) Heightened temperature and other signs of fever, (*e*) The excretion of a milk abnormal in appearance.

With the exception of (*c*), and a swelling which is very gradual, all the above phenomena are almost invariably absent in tuberculosis of the udder, with a consequent contentment of mind upon the owner's part.

Within the past 14 months it has been the writer's experience to have seen 14 cows affected with tuberculosis of the udder, nearly all of which were or had been recently producing tuberculous milk which had been sold for human consumption, used for the manufacture of milk products ; the feeding of calves and pigs ; or again as in the one case of a valuable pedigree, milk-recorded cow, the milk had been used to feed the farm bailiff's infants and subsequently the rearing of pedigree bull calves.

As I write I have just returned from a visit to a brother professional who showed me a milk smear teeming with tubercle bacilli and a tuberculous udder that was apparently one solid mass of tuberculosis. (This had supplied the milk from which the slide had been prepared). It was the organ of a cow which I understood had died of this disease and *which had apparently been kept for the milk supply of the owner's household.*

Among other interesting cases was one found as the result of a report being received of seven pigs from a farm being found to have been suffering from generalised tuberculosis, upon slaughter.

A visit to the farm revealed a cow suffering from an advanced

tuberculosis of the udder, *the owner admitting that since the cow's appearance was no longer pleasing, he had of late been using her milk to feed the pigs!*

Not in more than one of the 14 *cases mentioned did the owner even suspect that the abnormality, in some cases fairly obvious, was due to tuberculosis, or in cases less obvious had the abnormality even been observed.*

In other cases, several years ago in another area, a producer milking over 100 cows, upon my introduction to him, drew my attention to a most typical case of tuberculosis of the udder, saying, " This young cow has a marked swelling in the left hindquarter and the blessed thing won't go down, but keeps on getting harder. I don't suppose you or anyone else can tell me what it is due to."

I may be allowed to point out here that loss of condition does not of necessity or invariably accompany a tuberculosis of the udder, and I have come across some instances, including two of the 14 mentioned, where beyond lesions found in the udder substances there were not any very pronounced lesions throughout the organs or upon the serous membranes beyond a well-established caseation and calcification of the mesenteric glands, which lesions are invariably found to be accompanying all cases of tuberculosis of the udder.

Considering that the foregoing has been one's experience in a part of the country which I consider may be classed as being fairly free from bovine tuberculosis, in comparison with other areas I have in mind, it is not surprising that one should be willing to see the risk of the " cleanliness " of milk production being given precedence over the " purity " of its supply.

Despite the recent enactment concerning the tuberculous beast which only assists in the elimination of the very definitely affected bovine, nearly all of which are therefore heavily infected and have performed their possible maximum of damage by the time they are slaughtered, one longs to see some sign of the nation's encouragement to the production of milk from tubercle-free cows, and thereby the setting up of herds of cattle free from this disease.

It is readily admitted that this is an ideal entailing enormous expense and years of organised endeavour, but, judged from the Public Health aspect, it would appear to be absolutely essential, in the meantime, that Health Authorities undertake to have every milk-producing cow periodically examined by a qualified veterinary surgeon. For this purpose I would suggest as a slight modification of the examination and certification stipulated under the Milk and Dairies (Special Designation) Order that this be done every three months as in the case of the producers of " Grade A " milk.

This, in my firm belief, is a national necessity, despite the most perfect attainment of "cleanliness" that may be reached in the production of this, which is properly classed as our most valuable food, but only so in those instances where its purity of origin is certified by competent examiners.

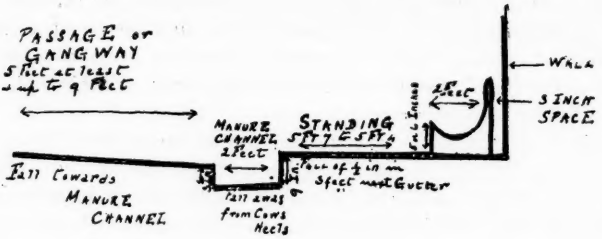
Did time and space permit one could say a great deal more concerning those producers (I call them true patriots) who go to the expense of the production of "certified" milk, being given no material assistance whatsoever in the testing of their herds, but are mulcted to the extent of £5 per annum for the honour of being licensed to benefit public health and increasing the value of the live-stock of our country.

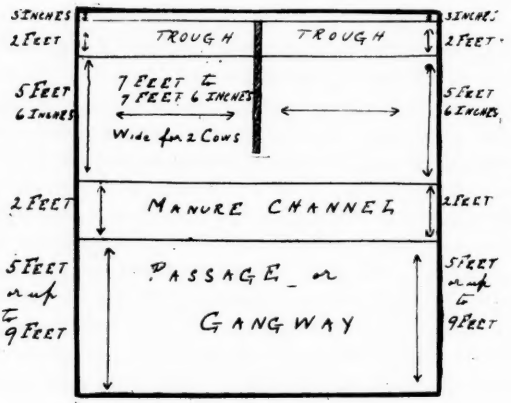
THE PLANNING OF COW HOUSE FLOORS.

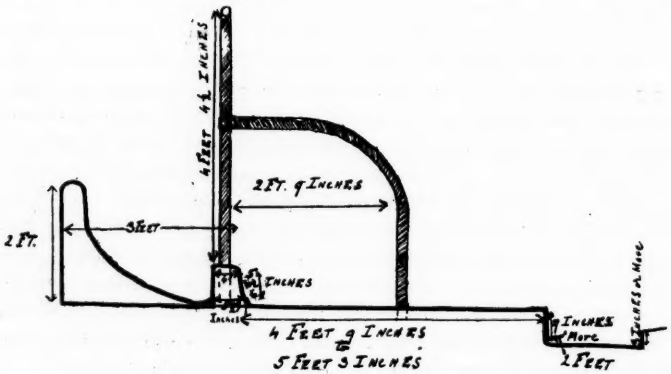
By G. MAYALL, M.R.C.V.S.

THE ideals to be aimed at in connection with the stalling of cows, and in order to produce clean milk, are to make them comfortable, to keep them clean, and to prevent them soiling their hind parts. For their comfort, and as an aid to cleanliness it is important that they should be able to lie easily with their heads over the manger when down. In order for this to be done a height of 12 in. at the front of the trough need never be exceeded and in many cases 6 in. will be enough. If much higher there is also danger of the cow hitting her brisket when getting up. Where cows face a wall the back of the trough should be set at least 3 in. from the wall and the space between be cemented up. The standing for a cow should never far exceed in length that which will enable her when on her feet to have her hind heels a few inches from the edge of the gutter, so that her dung and urine clear the platform and drop easily into the gutter. If the length of the standing is such that when the cow moves forward she soils the hind part of it and then moving back lies in her own dung and urine, attendants will soon get fed up with trying to keep her clean. We think the tie rod for neck chains is better 2 ft. from the front of the manger than 2 ft. 6 in. The piping neck yokes, now fairly common, help to keep cows in position, and, if swinging, are comfortable and handy. As a general rule for the average cow (cross-bred Shorthorn), 5 ft. 4 in. to 5 ft. 6 in. will be the length of the standing from the front of the manger to the edge of the gutter. The length of the standing where stanchions (neck yokes) are used is often shorter, 4 ft. 9 in. to 5 ft. 3 in. If there is a hay rack above the manger the standing will have to be about 5 ft. 9 in. long. Welsh cattle, Jerseys and Kerries will require shorter standings and Ayrshires longer.

The width of the manure channel should be at least 2 ft. and may


PASSAGE or GANGWAY
5 Feet at least and up to 9 Feet
MANURE CHANNEL 2 Feet
STANDING 5 Ft 7 & 5 Ft 6
Fall Inches
2 Feet
WALL
3 INCH SPACE
Fall towards MANURE CHANNEL
Fall away from Cows Heels
Floor of 4 in in 5 Feet next Gutter





Plan with Stanchions or Neck Yokes.

with advantage be wider. Some cows will shoot their manure over the gutter on to the gangway behind, so it is well to have it wide enough. There are differences of opinion as to the depths of the gutter. On some of the Dutch farms they are about 1½ ft. deep. It must be remembered that in many cases the gutters have to accommodate about 16 hours' droppings. Again, when a cow is lying down, the droppings ought not to be heaped up in the gutter so as to be in contact with her tail, perinæum and buttocks. Deep gutters prevent the dung splashing far forward and backward.

A common depth measurement of the gutter which must slope away from the cows' heels is 6 in. next the cow and 4 in. away from her, but this measurement only applies where cows are frequently mucked out.

The gangway which should be laid at a level three or four inches below the cows' beds, should be at least five feet wide and for a single row of cows the wall behind them will get splashed with manure if it is 6 ft. wide.

Stalls for a pair of Shorthorn cows should be 7 ft. to 7 ft. 6 in. wide. Varied material is used for the floor surface of stalls. Concrete entirely, bricks grouted in cement, rammed clay or chalk at the front (said to prevent big knees) and cement behind, whilst one man in Ireland made a very satisfactory floor with one part of Portland cement to five of boiler cinders, covered this with tar and sprinkled this well with cork particles such as are used for packing grapes.

MILK (SPECIAL DESIGNATIONS) ORDER, 1922.
SOME COMPARISONS AND CRITICISMS.

By H. W. STEELE BODGER, M.C., M.R.C.V.S., *Tamworth*.

The special designations are :—

(1) Certified ; (2) Grade A (T.T.) ; (3) Grade A ; (4) Grade A (Pasteurized) ; (5) Pasteurized.

Briefly the requirements are that the milk shall be bottled and the bottles sealed ; that the milk on a sample being taken at any time before delivery to the consumer, shall not contain more than a given number of bacteria per c.c., and no acid-forming bacillus in given parts of a c.c. The cap shall bear the name of the grade, the day of production and the name of the farm or dairy where the milk is bottled.

Certified Milk must not contain more than 30,000 bacteria per c.c., and no acid-forming bacilli in 1/10th c.c. It must not at any time be treated by heat.

Grade A (T.T.) and Grade A must not contain more than 200,000 bacteria per c.c., and no acid-forming bacteria in 1/100th c.c. ; it must not be treated by heat.

Grade A (Pasteurized) must not contain more than 30,000 bacteria per c.c., and no acid-forming bacteria in 1/10th c.c.

Pasteurized Milk must not contain more than 100,000 bacteria per c.c.

Pasteurized milk must be retained at a temperature of not less than 145° F., and not more than 150° F., for at least 30 minutes, and immediately cooled to a temperature of not more than 55° F.

What vital difference is there between Certified milk and Grade A (T.T.)? None at all.

The difference in bacterial counts (30,000 and 200,000) is negligible, the difference in acid-forming bacilli (1/10th and 1/100th) is not vast; there is certainly no producer of milk of the required standard of Grade A (T.T.) who could not easily and, indeed, who does not usually produce milk of the standard required for Certified.

The main difference is this: Certified milk must be bottled on the farm where it is produced; Grade A (T.T.) may or may not be bottled on the farm.

Granted, sometimes Grade A (T.T.) milk has to travel fairly long distances before being bottled, but this is usually compensated for by the more adequate provision for brine cooling and bottling the milk, and the sterilizing of the bottles and churns at a town dairy.

Between Grade A (T.T.) and Grade A, however, there is a vital difference, though to the lay mind these two grades are identical. They require the same bacterial standards, yet the one is practically a guarantee of freedom from tubercle bacilli, whilst the other is not.

It would surely be far better to raise the bacterial standard of Grade A (T.T.) to that of certified milk, make the bottling on farm optional, and so *classify tubercle-free milk as one grade, distinct and distinguishable from all other milk.*

The Ministry have made one big blunder in framing the conditions for Grade A licences. It is stated in the third schedule, Part IIIa (1) " No animal which to the knowledge of the owner of the herd has at any time been tested with tuberculin and has reacted to the test, shall form part of, or be added to the herd."

This condition undoubtedly deters many farmers from taking out a Grade A licence or from endeavouring to advance from a Grade A to a Grade A (T.T.) licence.

Imagine the position of the holder of a Grade A licence who wishes to secure a licence to produce Grade A (T.T.) milk. His first step is to have his animals tested; his percentage of reactors is anything up to 100; he automatically forfeits his Grade A licence for allowing animals known to have failed to pass the test to form part of his

herd. How many holders of Grade A licences would be willing to run the risk?

By all means prohibit the *addition* to the herd of any known reactors; but why penalise an enterprising and progressive farmer who endeavours to get a tubercle-free herd? Even a time limit to eliminate known reactors would be fairer than the present conditions.

Grade A (Pasteurized).—Speaking frankly, milk which does not conform to the standard of Grade A milk is not fit to pasteurize, and milk which does conform to the standard of Grade A should not require pasteurizing. However, one appreciates the fact that pasteurized milk is a good friend to the retailer because it does not go sour, and there are, therefore, no losses from that cause.

I admit that perhaps at present pasteurized milk may be a necessary evil in some large towns, and that some of the large firms, such as the United Dairies Company, are doing a lot towards the making of milk "safe" so far as is possible. But the fact remains that the knowledge that milk is to be pasteurized or sterilized is not an incentive to *produce* clean milk. Again, once a bottle of pasteurized or sterilized milk is opened, it is a far more dangerous commodity than raw milk, because it may become heavily contaminated without showing it, whereas raw milk does have the decency to go sour and become obviously unfit.

My sympathy is with the firm who sends out clean milk in a sterile bottle, only to have it poured by a brainless housewife into what is (bacteriologically speaking) a filthy jug or basin.

I have before me a list compiled in the laboratories of the Midland Counties Dairy Co., Birmingham, of the bacteriological counts for February, 1927. In this month milk was received from 112 farmers. The lowest count was 355 bacteria per c.c. Eight farmers were under 1,000 bacteria per c.c.; 41 were below 5,000 bacteria per c.c.; 60 were below 10,000 bacteria per c.c.; 82 were below 20,000 bacteria per c.c.; 93 were below 30,000 bacteria per c.c.; 108 were below 100,000 bacteria per c.c.

Of the remaining four, two were under 200,000 and two were over 200,000, the highest count being 335,500.

Briefly, this means that 83 per cent. is of certified standard, and 98 per cent. is of Grade A standard.

This is, indeed, *very* clean milk, *produced clean*, and is secured by the payment of clean milk bonuses to the producers. This, to my mind, is preferable to trying to make milk clean by treating it by heat.

Surely it should be possible to convey this clean milk to large towns such as London and to keep it clean en route.

The United Dairies Co. has huge glass-lined tanks for bringing milk up from the country. Now if these tanks were provided with a brine jacket, the milk could be retained at a temperature of 45° F., and so vastly increase its keeping properties.

Lastly, when one compares the relative merits of clean raw milk with milk treated by heat, one cannot do better than quote the results of an investigation made in New York by M. Ladd, H. W. Ewarts and L. W. Franks.

It was found that certified raw milk alone, without the addition of orange juice or cod liver oil, produced a greater increase of body weight in babies than did pasteurized milk alone, or when pasteurized milk was combined with orange juice and cod liver oil.

The experiments showed that the normal development of the babies as judged by weight increased 14 per cent. on certified raw milk against 1·7 per cent. on pasteurized milk alone, 7·9 per cent. on pasteurized milk with the addition of orange juice, and 9·5 per cent. on pasteurized milk with the addition of orange juice and cod liver oil.

A. L. Daniels and G. Stearus of the Iowa Child Welfare Research Centre, found that in experiments on rats that when the rats were fed on pasteurized milk their growth was half the normal.

STUDIES IN RINDERPEST IMMUNITY: (3)—*continued* * SIMPLIFIED TECHNIQUE FOR THE MANUFACTURE OF ANTI-RINDERPEST SERUM.

By H. E. HORNBY, F.R.C.V.S.,
Mpwapwa, Tanganyika Territory.

If, then, intrarumenal injection of massive doses of virulent material does stimulate the formation of antibodies, such injections should be followed by the same alteration in the proportion of euglobulin to total protein which Hartley found occurred after "hyperimmunisation" by the intraperitoneal route.

We examined serum obtained from each of six immune oxen prior to "hyperimmunisation." Four of these had been bled a number of times before and were awaiting their turn to come up for "rehyperimmunisation." The method of examination was as under:—

Two litres of blood were drawn into a clean, dry bleeding-jar. A weight was dropped on the clot 12 to 24 hours later, and after another 12 to 24 hours the serum was pipetted off, and the necessary quantity was centrifuged for five minutes at a fairly high speed.

* Previous articles of this series appeared in the November (1925) and the July (1926) numbers of the VETERINARY JOURNAL.

Into a cylinder were then put 20 c.c. of distilled water, 11 grammes of common salt and 10 c.c. of this clear serum, and these were well shaken. Saturated salt solution was then added to the 100 c.c. mark, making due allowance for froth, and the whole again well shaken. The cylinder was then set on one side for about four hours, after which the precipitate was filtered off. By the Kjeldahl method the amounts of nitrogen in 1 c.c. of whole serum and in 10 c.c. of filtrate were determined, and by subtraction the amount of nitrogen contained in the euglobulin which had been precipitated was obtained.

The protein content of the serum of these six different animals varied considerably :

Date.	No. of Ox.	Previously "Hyper-immuned."	Total Protein (as gm. N.) in 10 c.c.	Insol. Protein (as gm. N.) in 10 c.c.	Proportion of Insol. Protein to Total. %
9/6/26	315	7/4/26	·0630	·0126	20
26/6/26	389	27/1/26	·0805	·0140	17·4
28/7/26	1008	5/5/26	·1092	·0448	41·0
4/8/26	182	31/12/25	·0728	·0056	7·7
11/8/26	51	Never	·1036	·0070	6·8
7/9/26	371	,,	·0994	·0266	26·7
		AVERAGE ...	·0881	·0184	20·9

A random sample of our ordinary carbolised "hyperimmune" serum, as it is issued for field use, was subjected to the same form of examination and was found to contain :

Total Protein (as gm. N.) in 10 c.c. .. ·0912
Insol. ,, ,, ,, ,, .. ·0301
Proportion of Insol. Prot. to Total .. 37·1%

that is, compared with average immune serum, the "hyperimmune" serum possessed increased total protein, increased euglobulin, and increased proportion of euglobulin to total protein.

This general conclusion was strengthened by examination of the serum of two individual oxen before and 10 days after "hyperimmunisation" by the intrarumenal route. Both were old serum makers which had been bled many times before, but before the test "hyperimmunisation" their sera varied very much in the proportion of euglobulin to total protein. After "hyperimmunisation," however, *there was in each case an increase in the quantity of total protein, in the quantity of euglobulin, and in the proportion of euglobulin to total protein.*

	Total Protein (as gm. N.) in 10 c.c.	Insol. Protein (as gm. N.) in 10 c.c.	Proportion of Insol. Protein to Total. %
Ox 1008—			
Before " hyperimmunisation"	·1092	·0448	41·0
After ,,	·1218	·0560	46·0
Ox 182—			
Before " hyperimmunisation"	·0728	·0056	7·7
After ,,	·0894	·0392	43·7

It was still necessary to ascertain that this pronounced tissue response was not due to either (*a*) the massive dose of blood, as such, or (*b*) the small quantity of virus which escapes into the skin and peritoneal cavity during the process of passing the main mass of virus into the rumen.

A transport ox which had been working on the laboratory farm since he was actively immunised against rinderpest four years before, was bled and his serum examined. He then received a series of injections at 10 days intervals, as follows :—(1) 2,000 c.c. normal blood intrarumenally, (2) 5 c.c. of virulent blood subcutaneously, and (3) 2,500 c.c. virulent fluid (liver extract, etc.) intrarumenally. *The only unmistakable response followed the injection of the massive dose of virus.*

	Total Protein (as gm. N.) in 10 c.c.	Insol. Protein (as gm. N.) in 10 c.c.	Proportion of Insol. Protein to Total. %
Before inoculations	·0700	·0154	22·0
10 days after 2,000 c.c. Normal Blood intrarumenally ...	·0707	·0119	16·8
10 days after 5 c.c. Virulent Blood subcutaneously ...	·0476	·0126	26·5
10 days after 2,500 c.c. Virulent Fluid intrarumenally	·0616	·0294	47·7

Thus were overcome any theoretical objections which might have been brought forward against the intrarumenal method of " hyperimmunisation," which we have adopted in preference to any other, and which has been the routine one at this laboratory for four years.

Another way in which our technique differs from that practised

elsewhere is in the use of bleeding-jars of galvanised iron made by a local coloured artisan, instead of expensive glass ones. It was found, however, that the clots seemed to grip the comparatively rough sides of these jars, so that only a small percentage of serum was obtained. We have been able to remedy this by filling the jars with five per cent. Jeyes Fuid for some days prior to it being tipped out an hour or two before they are filled with blood. It is necessary that the dilution of the Jeyes Fluid be made with *hard* water, to obtain a tarry as opposed to a bland emulsion. By this means the percentage of serum obtained is about 48, instead of the 29 per cent. which we obtained when we used jars sterilized by heat alone. The thin lubricating film of disinfectant disseminating into the serum certainly makes this look cloudy and gives it a tarry odour, but thereby the keeping properties of the product are improved and its titre does not appear to be impaired.

Titre of Intrarumenal Serum.—Reports from the field concerning the value of this serum have been uniformly favourable, but of much greater value are the results of controlled tests in a laboratory. During the last three years we have tested our serum by inoculating, at different times, an aggregate of 180 susceptible cattle with virus, and, simultaneously but on the other side of the body, with from 20 to 40 c.c. of serum. As controls, during the same period, 75 susceptible oxen were inoculated with virus alone.

Of the 180 double-inoculated cattle—

2 (1·1%) died from rinderpest.
18 (10%) recovered after severe reactions.
160 (88·9%) ,, ,, mild ,,

Of the 75 controls—

22 (29·3%) died from rinderpest.
27 (36%) recovered after severe reactions.
26 (34·7%) ,, ,, mild ,,

Four important factors play their parts when double inoculation is practised. The first is the natural resistance of the animal, the second is the virulence of the virus, the third is the potency of the serum, and the fourth is the care given to the sick animal.

Considering the preceding tests as an aggregate, the second and fourth factors were common to the double-inoculated cattle and to their controls, the first factor was reduced to small proportions by the comparatively large number of animals used ; so that the difference in result may reasonably be attributed to the action of serum.

Present Method of Serum Manufacture.—Our serum-makers are drawn from a herd of more than 200 large, healthy oxen which are immune to rinderpest. The members of this herd are divided into

four classes according to the number of times they have been hyper-immunised. Depending on the demand for serum, either two or four of each class are " hyperimmunised " weekly, and as after " hyper-immunisation " each beast is bled five times in as many successive weeks, our herd of actual serum-makers is always some multiple of eight. Taking 40 as the usual number, the routine procedure is as follows :—

Each week two supposedly susceptible oxen are injected sub-cutaneously with about 10 c.c. of virulent blood and are then brought into an infected shed and, if possible, put in the same loose box as a beast clinically ill with the disease. This is to give them a good chance of getting infected by contact consecutive to their original infection by injection. If both react, only one, the virus producer, is used ; the other acts as a virus control. From the virus producer two bleedings, each of 2,000 c.c., are drawn from the jugular on successive days before he is chloroformed and bled to death from the carotid. From the blood so obtained four serum-makers, one of each class, are " hyperimmunised " by receiving 2,000 c.c. intrarumenally through a canula. Any blood in excess of these 8,000 c.c. is mixed with a watery extract of the abdominal viscera and heart, and the resulting virulent fluid is given in doses of 2,500 c.c. intrarumenally to the remaining four serum-makers. Thus four serum-makers are, it is hoped, hyperimmunised with pure virus, and four with a mixture of virus and secondary invading organisms.

Each serum-maker is kept under observation and temperatured daily for not less than 10 days before he is subjected to five weekly bleedings, each of 3,500 c.c. of blood drawn from the jugular. Weights are dropped on the clots after the blood has stood 24 hours. Then, after 48 more hours, the serum is aspirated off through measuring vessels into sterilized milk-churns connected in series. Before entering the churns a little carbolic acid (half per cent.) is added. When not less than 300 litres are available, the mixed serum is transferred to stoppered milk bottles, and the brew tested in the ordinary way. The result of this arrangement is that each week one virus producer is bled to death, and about sixty litres of serum of uniform quality are obtained. If occasion demands, the whole procedure is duplicated to yield double the quantity of precisely similar serum, and if absolutely necessary the procedure could be triplicated to yield a weekly output of 180 litres (6,000 doses of 30 c.c. each) of serum.

Our output of this serum during 1925 was 4,621,000 c.c., and the estimated cost of production was less than sixpence a dose of 30 c.c.

SUMMARY.

A brief description of a method for producing anti-rinderpest serum of good titre and uniform quality, which is believed to possess advantages over other methods.

I desire to acknowledge the great help received from my former colleague, Captain G. N. Hall.

THE TREATMENT OF FOOT AND MOUTH DISEASE IN CATTLE.*

BY DR. VENDEL, M.D.,

Rask Molle, Denmark.

IN examining blood from animals during the acute attack of foot and mouth disease, I have found, by using an original method based upon new principles for blood-staining, that the plasma contains micro-organisms, both fungi and bacteria. The fungi, which are considered to be the essential part of the infection, are morphologically very similar to the monilias or closely related members of the order of *fungi imperfecti*. They are present in blood as conidia and also in spore form. The spores are very different in size, the smallest ones seen being close to the lower limit of visibility. Probably there are smaller ones, too small to be seen and small enough to pass through a Chamberland filter. If this proves to be true, the virus will have to be considered a visible and stainable, but filterable, virus. It is probable that this view of the virus as a *fungus imperfectus* will make it easier to cultivate the micro-organism. If it proves to be a monilia or closely related fungus, temperatures below 18-20° C. will be necessary and substrates containing sugar, and preferably such substrates as have proved best for monilias and related fungi, will have to be used.

HYPOTHESIS IN REGARD TO PATHOGENESIS.

The bacteria are considered to be a secondary infection, emigrating from the intestinal flora through the endothelium of the intestinal blood-vessels, which has suffered (by action of the toxins of the fungus infection) sufficiently to let a bacterial invasion pass through. The bacteria in the blood-stream are of several different kinds, all representative of bacteria living in the intestines; the species and number of species present in the blood varying from one individual to another.

A serum originating from an infection of this kind must be not only polyvalent, but also varying according to the particular source (the particular individual) from which the serum has been taken. It is probably entirely or almost entirely bacterial in origin, only to a small extent originating from the fungus infection.

* "Ugekrift for Lager," August 26 and September 2, 1926.

Treatment.

The rational and logical treatment of an infection such as here described, must be directed against the primary infection to endeavour to destroy this, and especially attempt to do this at such a time that the conditions favouring the secondary infection do not get a chance to set in.

This I have attempted to do by using intravenously drugs considered to be specific against fungi of the group of monilias, and using these as early in the course of the disease as possible ; eventually for prophylactic purposes even earlier. Preparations of iodine have been used with decided success.

Clinical Articles

FACIAL PARALYSIS IN A COLT.

By R. HUDSON, F.R.C.V.S.,
Retford.

The subject was a young hunter gelding which I was asked to see, because the owner thought I might cut a piece out of one side of his mouth and make it level !

The lips were drawn up on one side, and on the other they hung pendulous, exposing the teeth and gums. They appeared to have increased in length from disuse and the appearance was very unsightly.

The owner attributed the condition to the colt having bit himself repeatedly on the mouth when he was being first haltered. He informed me that for a long time the colt fought at the halter with his fore feet and that several times he hit himself about the nose, but he would not admit that he had been over or bruised his head.

The muscles on the upper and lower jaw of the near side had almost disappeared.

Considering that the condition had been in existence six or seven months I did not see much chance of recovery, and told the owner so.

An operation was not likely to do any good, for, as I pointed out, the trouble lay very near the nerve centre. The colt was then at the breakers where it remained for four or five weeks, and when it left the condition of the lips was definitely improving.

Two months later the animal had completely recovered.

A CASE OF TEMPORARY PARAPLEGIA IN A MARE.

By R. HUDSON, F.R.C.V.S.,
Retford.

The subject, an eight-year-old shire mare, had been out at grass and working occasionally. She had been sent with a load of hay,

for which she had had to wait whilst it was cut, being tied up for about an hour whilst it was given to cattle in the field.

It was a cold, foggy day and on the way home she failed to hold the cart, was difficult to guide, and wanted to walk sideways ; sweating very profusely. She was removed from the cart and led home.

When I saw her some four hours later she was in a large loose box wet with perspiration, which was steaming from her. Her pulse and temperature were about normal and breathing slightly hurried.

Her lips were pulled to the near side, and when moved she advanced the near foreleg in an exaggerated manner, so much so that the owner thought she must have toothache. Movement appeared to distress her, and, I think, caused her to sweat more profusely.

Her pupil contracted normally to light. I had her made comfortable with plenty of bedding. A rug was put on with straw next her skin to allow the perspiration to escape.

A six-drachm dose of aloes and four gr. of morphia were given, and I arranged to see her next morning.

I was surprised to find her quite all right. She was feeding, the position of the lips was normal, and when walked no sign of the exaggerated extension movement could be observed. I wonder what brought about the temporary symptoms of paralysis ?

Reviews

Protozoology : a Manual for Medical Men, Veterinarians and Zoologists. By C. M. Wenyon, C.M.G., C.B.E., M.B., B.S., B.Sc. (Lond.). 2 vols., royal 8vo, pp. 1564, with 569 illustrations and 20 coloured plates. London : Baillière, Tindall & Cox. Price 84s.

This book will be welcomed by students and workers, both veterinary and medical, filling as it does, a distinct need. Though it deals with both sections of the subject, naturally most attention is devoted to the parasitic groups. The information available about these, especially during the past quarter of a century, is scattered about here and there in numerous journals and is often accessible only after diligent search and much burning of midnight oil. Especially to the worker in the tropics who has no access to a library, this manual should prove of great value. It provides a reliable record of what is known on the subject up to the beginning of last year.

There are special sections dealing with the parasites which may develop in invertebrates, a study of these being essential to the understanding of the life history of certain parasitic protozoa in vertebrates.

A section is also given to spirochaetes on account of their intimate relation to protozoa. This section will prove of great interest to veterinarians working in India, in connection with spirochaetosis in fowls.

The section on methods of investigation should prove a useful guide to students.

Authorities are quoted for all statements, and the list of publications at the end of the book facilitates reference to the originals.

The drawings are executed with artistic skill, and evidently no pains have been spared in preparing the book for the press.

The specialist will find the book of inestimable value in enabling him to keep abreast of knowledge outside his own particular field.

Some of the experiments conducted and results claimed, e.g., the case of the transmission of pathogenic trypanosomes by species of Tetanus are highly interesting reading, and may be pregnant of important consequences in countries where camel transport is of importance. It has been proved that Surra, a disease which works havoc in India amongst camels and horses, is caused by *T. Evansi*, although the evidence of a cycle of development has not been so far demonstrated, probably a cyclic development occurs in ticks, though further investigation is desirable to establish scientific certainty.

No veterinary or medical officer working in the tropics should be without this manual.

Animal Diagrams for Students of Animal Industry By D. J. ANTHONY, M.R.C.V.S., D.V.S.M. London: Baillière, Tindall & Cox, 1926. Price 25/-.

IT is good to see a member of our profession moving with the times and recognising the fact that the qualification for which he studied is not merely one which makes him proficient in the study of the diseases of the animal when alive, but which enables him to branch out into other fields in which the knowledge he has acquired should (and does) make him by right, " the man in authority."

Veterinary Science has many sides to it, and the members of our profession have been stupidly and apathetically slow in not recognising this years ago.

Mr. Anthony is helping to pioneer a new line for the graduates who will follow after him; in that he is not only proving himself, by the position which he holds as veterinary inspector to a very large bacon factory, to be competent in the practical side of meat inspection, but he is taking up the attitude that the education of the butcher and the butcher's man in things which pertain to their everyday calling, is as wise as it is necessary.

In acting as the lecturer to the classes of the National Federation of Meat Traders' Associations, Mr. Anthony is doing good work for his profession, and it is in this category that he has persuaded Messrs. Baillière, Tindall & Cox, the well-known veterinary publishers, to produce a series of animal diagrams specially selected and drawn for the students of the animal industry, and particularly adapted for Mr. Anthony's own lectures, in the sketching of which he has shown himself to be an artist of no small merit. The sketches are clear, easily read and understood, and particularly adapted for lectures of this kind. The price is cheap, and they will be found exceedingly useful to any veterinary surgeon who wishes to demonstrate, from the butcher's side, the " points " of the cow and the pig.

Abstracts of Current Literature

Jordanoff, Dr., Erfurt Clinic.—Amputation of the Penis in the Dog.— (*Deutsche Tierarzt Woch.*)

A HOUND about 11 months old had suffered badly for some time from distemper and as a result nervous twitchings with the hind limbs, the head, and finally *paralysis of the penis* had resulted. After unsuccessful internal treatment with arsenic and external fomentations, massage and so on at the hands of other practitioners, the dog was brought to my clinic.

Placed on the table, the patient stood with arched back and continued twitching of the hind limbs. The penis slightly swollen, dark blue and necrotic, hung out from the prepuce up to the glans penis and had been so for five weeks. With difficulty the penis could be put back, but immediately came out again. The urine was of normal colour and smell.

On my advice the owner consented to an operation. The operation was done under local narcosis in the back. The agent used was Nosuprin Merz. The patient was first castrated—covered operation—to do away with further sexual desire. The site of operation was shaved, washed with soap, cleansed with benzine spirit and ether and painted with tincture of iodine. Also the penis itself was painted with 10 per cent. warm therapogen solution.

The amputation was not performed in the continuity of the penal bone, since there was preputial catarrh present which would infect a bone wound and cause necrosis. Extirpation of the whole penis was decided on. The prepuce and the skin in the middle line were split right up to close under the anus and the whole penis laid free. Then the penis was separated from the abdominal muscles and a firm elastic ligature put on behind the glans. Half a centimetre in front of this, but behind the glans the penis was cut through, but the urethra was spared, a sound having been previously inserted. The arteries and external and internal pudenda veins were ligatured. Then the urethra about one centimetre from the incision was split and separated and its edges sutured to the sides. Likewise the edges of the wound were closed with a button suture and the ligature taken off.

In order to avoid wound infection the patient was given 4 c.cm. of introcid into the jugular vein. This injection was repeated on the next day.

The operation wounds healed per primaur in eight days. The sutures were taken out and the patient was discharged cured. The twitchings still continued. To strengthen the body the dog received

1·5 c.cm. of revonal hypodermically and daily and as food raw meat, unshelled rice, an egg daily and cod liver oil. After three months I had the opportunity of seeing the dog again. His bodily condition was markedly better, urine was passed without difficulty, the wound cicatrix was scarcely discernible.

THE SECOND CASE.—A mongrel fox terrier about four weeks old belonged to an artisan. According to him paralysis of the penis had persisted for a few weeks and the cause was quite unknown.

All attempts to remedy the condition had failed. The dog was in good condition, quite lively and perfectly content with his state. I carried out an operation as in the first case. Healing took four weeks as the dog kept licking the wound. I saw this dog a year later. His condition was good.

THE THIRD CASE was in an eight-year-old German dog belonging to a butcher. In serving a bitch he was bitten by her on the penis. The wound quickly became infected and the penis hung out of the sheath. Also here the whole penis was removed as previously described and the wounds healed per primaur.

[There is not much about this operation in veterinary literature. In Steel's book on the "Dog," 1894 edition, at p. 168, it is interesting to read as follows: "In a case of cancer of the whole of the corpora cavernosa I recently removed the whole penis and testes, leaving the opening of the urethra in the perinæum. Remarkably little blood escaped on operation, but the patient being in an extremely weak state died in three hours from exhaustion."—G.M.]

Narayanan, R. S., G.M.V.C., Veterinary Inspector Rampur State.—Impaction of the Colon in an Elephant.—(*Indian Veterinary Journal.*)

IMPACTION of the colon is not a rare occurrence in this subject. Very often this affection causes considerable anxiety to all concerned. Fortunately the indications in nearly all cases of impaction are sufficiently clear for an almost correct diagnosis. On the recognition of the above fact, a practitioner is not to be led away to treat cases on routine lines, but every endeavour should be made to ascertain the history of the circumstances preceding the affection and treat cases according to the symptoms presented. The factors which go to contribute to this intestinal affection in elephants are commonly from the frequent swallowing of earth. It may be noted that the elephants very often do swallow large quantities of earth to get rid of the too numerous parasites in the alimentary canal and occasionally due to the deficiency of salts, particularly phosphates, in the system

and also in chronic indigestion. Salt licks are often observed in young and growing animals.

The subject under review is a cow-elephant named "Champa," aged 55 years. The animal was out in a tahsil in connection with flood relief work and returned to Filkhana at about 9 a.m. on July 23rd, 1926, with the complaint that the animal had a salt lick and was unusually off feed the previous day. It was also reported that the animal passed two dung balls to the size of a big football on her return march to the house. The mahout, as usual in all salt-lick cases, administered four chataks (8 ozs.) of common salt in half seer of gur (1 lb. of jaggery).

July 23rd, 1926. Prominent symptoms were: Temperature 97.8°F., urination normal; thirst excessive; visible m.m. slightly injected; off feed; fæces passed during the day was in smaller quantities than normal and slept as usual at night.

July 24th, 1926. Animal depressed; temperature 98.2° F., urination normal; thirst normal; total absence of passage of dung since the previous night; animal often crouched as though to lie down but only to rise again quickly.

Examination per rectum revealed nothing except a quantity of mucus mixed with earth and also a few parasites (Murshida Falcifera).

The animal was given soap and warm water enema. Internally a ball containing Ammon Carb. 1 oz., Pulv. Nux Vomica 3 drams and Pulv. Zingiberis ½ oz. mixed in jaggery was given in the morning.

Repeated the enema in the noon and evening and the ball in the evening only.

July 25th, 1926. The animal had her usual sleep the previous night. Crouching symptom was almost absent. Inclined to feed in very small quantities, other symptoms remaining more or less the same.

Repeated the enema and the Ammon Carb. ball.

During the day the animal made a few attempts at defecation, and a little mucus mixed with earth was passed.

July 26th, 1926. Animal did not sleep the previous night, but was often crouching and getting up. Temperature 100.2° F., distended abdomen and frequently assumed a crouching position. Frequent opening of the mouth as if yawning, suppression of urine, off feed and reduced thirst.

Exploration per rectum revealed nothing within reach. Repeated enema and the animal passed urine.

Internally Aloin and Calomel, each two drams in bread was given. Warm water to drink was always kept accessible to the animal.

Towards noon the symptoms were aggravated. The mahout was

directed to walk over the region of the flank after putting the animal in a recumbent posture. This was continued for 15 minutes every half-hour on both flanks.

There was passing of wind and attempts at defecation.

At about 2 p.m. the animal was exercised for half an hour and on examination per rectum a hard dry mass was felt. Removed the mass with great difficulty and by gradual reduction. Later in the evening the animal was found straining a little to evacuate the bowels by her own exertions.

July 27th, 1926. Usual sleep the previous night.

Condition approaching to normal with the usual passage of dung.

Advised the mahout to feed the animal with small quantity of food and frequently till the organ gained the normal tone.

NOTE.—I have often observed the efficient peristaltic action from Aloin with calomel in elephants. Aloin is very convenient to administer with none of the ill effects of aloes.

Hupka, Prof. Dr., Veterinary School, Hannover—A Note on the Castration of Polar Bears.—*Deutsche Tierarzt Woch*, Dec. 18th, 1926.

THE proprietor of Hagenbeck's Circus desired me to castrate three polar bears which, during the rutting time, had become savage and unmanageable and could not be exhibited. Latterly they had been dangerous to the trainer and he hoped that castration would tame them. Complete narcosis was essential because without it control would be impossible, owing to their cleverness in getting out of bonds and their great strength enabling them to bite through or tear to bits any cords. According to Brehm's "Animal Life" the ancestors of bears were in the *Canidæ*. Fröhner, in his pharmacopœia, gives the dose of chloral hydrate for the dog as 0·5 to 0·8 grammes per one kilogramme of body weight and says that after 18 minutes complete narcosis sets in lasting from two to five hours.

The mere entrance into the cage of these bears meant danger, so that narcosis could only be brought about through the stomach and choral hydrate in milk suggested itself to me. A full-grown polar bear, according to Brehm, if one deducts the fat, averages about 880 lbs., or nearly 8 cwt. Consequently, taking the dog as a guide, the dose for the bear would be 200 to 360 grammes (or 6 to 10 ounces). This seemed to me quite too much. I let the oldest and strongest bear (six years old) thirst for 24 hours and gave him seven drachms of chloral in milk. He drank the dose without hesitation. It produced no apparent effect, so at the end of the hour I gave him a further dose of seven drachms and in 1½ hours after he showed slight narcosis.

He moved about, sat down and got up in the corner of the cage, closed his eyes, but did not lose sense of what was going on. When called he came up to the bars of the cage. I now let the bear thirst a further day and next morning gave him in one dose 100 grammes (about 3½ ounces) of chloral hydrate in about 2½ quarts (three litres) of milk. After some delay he drank the whole lot right off. During the first hour there was again no sign of narcosis. At the beginning of the second hour slight unrest set in, the bear marched up and down the cage and sought to climb up at the bars. About 1½ hours after taking the chloral he began to yawn. The yawning became almost uninterrupted and then loud growling occurred as we see in dogs. Then the gait became uncertain and the bear began to stagger. It was interesting to notice how the animal fought against the drowsiness; the more he staggered the more he sought to march up and down in the cage. Two hours after dosing he could no longer stand and lay on his belly. But it was not yet possible to approach him; at every touch he snapped and struck with his paws. Now and again he sprang up but immediately fell down again. Half an hour later, or about 2½ hours after dosing, drowsiness was so pronounced that he could no longer hold his head up and let it fall on his paws. The eyelids remained closed. Gradually he lay on his side and finally on his back. From this time, about three hours after the drink of chloral and milk, stupor and insensibility (narcosis) were complete and the bear, in the position he had taken up on his back, was easily tied up. The tying was done so that each limb was corded and fastened to the bars of the cage on each side. Over the neck and chest a thick cord was drawn and made fast to the bars. Castration could now be commenced in peace. Burdizzo pincers were used in order to avoid after treatment. The scrotum of polar bears has about the same position and character as in large dogs, but is longer and slacker; the testicles are longer and not so round. The cord is easily palpated and about as thick as a lead pencil. The cord was pressed to the side of the scrotum and crushed and the crushing repeated below the first crush. The success of the crushing may be noticed immediately by the marked dilation of the artery above the crushings. The testicle on the other side was dealt with in the same way. Narcosis was so good that the bear did not react to the operation in the slightest. After the operation the animal lay for about three hours in the same deep sleep and susceptibility was in complete abeyance. He could be plucked by the hair, the limbs moved up and down and even the claws grasped and moved to and fro. On pricking with a pin there was only slight reflex movement. The mouth was firmly closed. The attendant, a powerful man, could not open the jaws. Breathing

was regular and quiet. Towards the end of the third hour after the onset of complete narcosis the bear stood up spontaneously and drank half a bucketful of milk. Stupor completely disappeared in time, the bear still staggered, but took interest in his surroundings. Short time after castration diarrhœa set in and continued the whole of the next day and was almost like water. The general condition of the bear, however, was good.

The second bear received a like dose of chloral in the same way and was castrated similarly.

The third bear, being only three to four years old, was given 70 grammes of chloral, but this was not enough, and after two hours a further 20 grammes was given. After an interval of an hour, or three hours after the first dose, he was tied up with some difficulty, but narcosis was not so deep as in the two preceding cases. The bear slept two to three hours, but always reacted to call and touch.

CONCLUSIONS.—For narcosis of polar bears chloral hydrate is very suitable. The handiest way to use it is in milk by the stomach. A one day's thirst induces the animals to drink the draught. The stomachal dose for adult bears is 100 grammes. Complete narcosis occurs in 2½ to 3 hours after drinking the dose and continues for three hours. Harmful effects, apart from diarrhœa, are not noticeable. Castration, according to Burdizzo, answers well in the case of bears.

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